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Sampling and Analysis Plan

Duwamish River

Site Inspection

Seattle, Washington

EPA REGION X

Contract No. 68-W9-0046
Work Assignment No. 46-23-0JZZ
Work Order No. 4000-19-38-3300
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Site Inspection
Seattle, Washington

Prepared for
U.S. Environmental Protection Agency
Region X
1200 Sixth Avenue
Seattle, Washington 98101

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Sampling and Analysis Plan Duwamish River Site Inspection Seattle, Washington

Project Name: Site Inspections—Multiple Sites

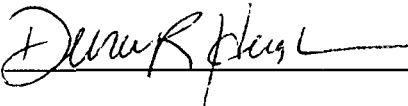
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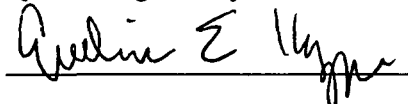
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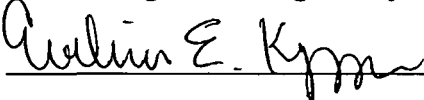
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SECTION 1

INTRODUCTION

Pursuant to United States Environmental Protection Agency (EPA) Contract No. 68-W9-0046, Roy F. Weston, Inc. (WESTON) is conducting a Site Inspection (SI) in the lower Duwamish River from river kilometer (RK) 2.5 to RK 11.5 (see Figure 1-1). The EPA SI process is intended to evaluate actual or potential environmental hazards at a particular site relative to other sites across the nation for the purpose of identifying remedial action priorities. The SI, under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 (SARA), is intended to collect sufficient data to enable evaluation of a site's potential for inclusion on the National Priorities List (NPL) and establish priorities for additional action, if warranted. The decision as to whether a site is placed on the NPL is made based on the EPA's Revised Hazard Ranking System (HRS) criteria. The HRS assesses the relative threat to human health and the environment associated with the actual or potential releases of hazardous substances at a site.

This Sampling and Analysis Plan (SAP), which will be used in conjunction with the Quality Assurance Program Plan (QAPP) (WESTON 1994a) and enclosed amendments (see Appendix A), describes the activities that will collect sufficient data to support an HRS evaluation. Moreover, the data collection efforts in the lower reach of the Duwamish River are intended to complement and support the other ongoing environmental and beneficial use projects and efforts being conducted by various agencies and interested parties to restore and enhance aquatic habitats within the Duwamish River corridor.

The overall goal of this investigation is to provide an assessment of sediment contamination in the lower reach of the Duwamish River. The specific objectives of this investigation are to:

- Characterize the nature and areal extent of sediment contaminant distribution in surface sediments located throughout the study area, and
- Preliminarily characterize the nature and vertical extent of sediment contaminant distribution in shallow subsurface sediments in localized areas.

The methods and procedures for sample collection and handling to address the above objectives are described herein, and will be pursued according to the 40 CFR Part 300, Hazard Ranking System, Final Rule. This SAP, and hence, the SI process, does not include extensive or complete site characterization, contaminant fate determination, or quantitative risk assessment.

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SECTION 2

BACKGROUND

2.1 SITE LOCATION AND DESCRIPTION

The Duwamish River originates at the confluence of the Green and Black rivers, then flows northwest for approximately 21 kilometers (km) and bifurcates at the southern end of Harbor Island to form the East and West waterways prior to discharging into Elliott Bay. The study area for this SI extends from the southern tip of Harbor Island (RK 2.5) to approximately 1.5 kilometers upchannel of the head of navigation (RK 11.5), also referred to as the upper turning basin or Turning Basin #3. The portion of the river that is maintained by the U.S. Army Corps of Engineers (Corps) as a federal navigation channel (i.e., the reach downchannel of Turning Basin #3) is typically referred to as the Duwamish Waterway. Navigation depths maintained by the Corps within the waterway generally range from -15 (in the upper reach) to -30 feet mean lower low water (MLLW) in the lower reach (WESTON 1994b).

The shorelines along the majority of the study area have been developed for industrial and commercial operations, as the waterway serves as a major shipping route for containerized and bulk cargo barge operators. Common shoreline features within the study area include constructed bulkheads, with manmade structures such as piers, wharves and buildings extending over the water, and steeply sloped banks armored with riprap or other fill materials (e.g., concrete slabs and miscellaneous debris). Intertidal habitats are widely dispersed in relatively small patches (i.e., generally less than one acre in size), with the exception of Kellogg Island, which represents the largest contiguous area of intertidal habitat remaining in the Duwamish River (Tanner 1991).

Stream flow for most of the Duwamish River is regulated by the Howard-Hanson dam upstream of the junction of the Green and Black rivers. The Corps has limited peak discharges to 12,000 cubic feet per second (cfs) at Tukwila and minimum flows to as low as 200 cfs, with an average flow of 1,500 to 1,800 cfs. Peak runoff occurs during winter rains, and low runoff occurs during the late summer dry season. (WESTON 1994b).

Tidal effects have been observed throughout the entire reach of the Duwamish River. Characteristic of an estuary, the water column in the lower Duwamish River is stratified by salinity: surface water is generally fresh or brackish; bottom water is more saline. This bottom layer (referred to as a "salt wedge") migrates upriver based on river flow volume and tidal stage, but tends to be persistent under low flow conditions and high tidal magnitude, being detected as far as 16 km upstream. (WESTON 1994b).

Substrate composition is variable throughout the study area. Available historical surface sediment data suggest the presence of coarser sediments (e.g., medium and coarse sands) in

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nearshore areas adjacent to combined sewer overflow (CSO) and storm drain (SD) discharges and riprap or similarly constructed banks, as well as in subtidal (scour) areas in the vicinity of the bridges that cross the river (e.g., the First Avenue South and 16th Avenue South bridges). Finer-grained sediments (i.e., silts and clays) have generally been encountered in the remnant mudflats, along channel sideslopes, and within portions of the navigation channel.

2.2 INDUSTRIAL OPERATIONS AND PAST INVESTIGATIONS

Much of the upland areas adjacent to the Duwamish River project area are heavily industrialized, and marine traffic within this lower reach of the river is considered to be intensive. Historical or current commercial and industrial operations include cargo handling and storage, marine construction, boat manufacturing, maintenance and repair, marina operations, concrete and other stone material manufacturing and distribution, paper and metals fabrication, food processing, and airplane parts manufacturing. In addition, this reach of the river is the receiving body for discharges from numerous municipal SDs and CSOs, as well as multiple privately held outfalls and drains.

Numerous past investigations within the lower Duwamish River have been conducted at varying scopes. A portion of the historical studies focused on specific properties, while the remaining studies were riverwide and incorporated sediment sampling as one component of the entire study. These past sediment studies have indicated that polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), metals (e.g., mercury), miscellaneous organic compounds (e.g., phthalate esters and chlorinated benzenes), pesticides, and organotins are present in the river sediments at concentrations that may cause deleterious effects to humans and aquatic organisms. PCBs and bis(2-ethylhexy)phthalate appear to be the most widespread contaminants of potential concern, followed by metals (primarily mercury and zinc) and PAHs. These contaminants may have entered the river via several transport pathways or mechanisms, including spillage during product shipping and handling, direct disposal or discharge, accidental spills, contaminated groundwater discharge, surface water runoff, stormwater discharge, or contaminated soil erosion.

2.3 AQUATIC RESOURCES AND CRITICAL HABITATS

The Duwamish River serves as a migratory route, nursery, and osmoregulatory transition zone for several species of salmonids, including coho (*Oncorhynchus kistutch*), chinook (*O. tshawytscha*), chum (*O. keta*), pink (*O. gorbuscha*), and sockeye (*O. nerka*) salmon, as well as steelhead (*O. mykiss*) and cutthroat trout (*O. clarki*) (WESTON 1998). Puget Sound Chinook salmon have recently been proposed for listing as Threatened species under the Endangered Species Act (ESA). In general, chinook and chum salmon use Elliott Bay and the Duwamish estuary more extensively than other anadromous species (WESTON 1998). Multiple migratory runs of both native and hatchery-reared salmonid stocks also occur seasonally in the Duwamish River and Elliott Bay (WESTON 1998).

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The Duwamish River is part of the traditional fishing grounds for the Muckleshoot and Suquamish tribes. Tribal members engage in net fishing for salmon during seasonal runs. Recreational fishing is also popular in the Duwamish estuary, with salmon sport fishing the most popular and most intensely managed recreation (WESTON 1994b).

Marine mammals, including harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) are known to frequently forage in Elliott Bay and have been sighted in the Duwamish River corridor (WESTON 1994b). Both mammals are classified by the Washington Department of Fish and Wildlife as state monitor species (WESTON 1998).

Numerous avian species are associated with the aquatic and remaining riparian habitats in the lower Duwamish River estuary. Aquatic birds, including summer resident or migratory species of dabbling or diving birds, and shore birds, such as dowitcher, dunlin, and sandpipers, are common within the study area. Piscivorous species recorded in the lower estuary include kingfisher and herons. Raptors, including hawks, osprey, and bald eagle, have also been observed (WESTON 1994b). The type of habitat use is not well documented for these species, but at a minimum, the lower Duwamish estuary likely serves as an adult forage area, and an osprey nesting site was observed during the site reconnaissance near the shoreline of the Birmingham Steel property. Bald eagle are also know to nest in the underdeveloped open spaces or parks in West Seattle.

SECTION 3

FIELD SAMPLING PROGRAM

3.1 OBJECTIVES AND APPROACH

Sampling activities will be conducted in the lower Duwamish River to generate data that can be used for HRS scoring, provide comprehensive information on contaminant distribution, and support ongoing and future investigations within the river. To accomplish these objectives, the field sampling program will focus on the collection of surface and subsurface sediment chemical data from intertidal and subtidal sampling locations throughout the lower portion of the Duwamish River. A grid sampling approach was determined to provide the most comprehensive coverage of the study area meeting the objectives of the sampling program, as well as meeting the majority of the requested data needs of the other agencies and interested parties that participated in a 17 June 1998 Duwamish River SI scoping meeting.

Prior to selecting specific sampling locations, five discrete river reaches representing approximately equal areal coverage were established for data management and evaluation purposes. The reaches are delineated in Figure 1-1 and defined as follows:

- Reach A: RK 2.5 - RK 4.5
- Reach B: RK 4.5 - RK 6.5
- Reach C: RK 6.5 - RK 8.5
- Reach D: RK 8.5 - RK 10.5
- Background Reach: RK 10.5 - RK 11.5

Within the above-defined reaches, investigations of contaminant distribution will be based on the collection of sediment primarily from nearshore and channel sideslope areas, with more limited sampling of the navigation channel. The navigational channel in Reaches C and D will be investigated by the Corps of Engineers following PSDDA protocol in the summer of 1998. Nearshore stations will generally be positioned in the mid- to lower-intertidal zone (defined for this study as +6 to -4 feet MLLW); channel sideslope stations will be located in the shallow subtidal zone, from approximately -4 to -12 feet MLLW; and channel (subtidal) stations will be placed within the navigation channel or midway between the two opposing shorelines. At the discretion of the field coordinator, a subset of the nearshore samples may be collected in upper intertidal areas (e.g., +6 to +10 ft MLLW), where adjacent to residential communities.

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Because of the lack of available, comprehensive bathymetric coverage for the study area, it is not currently possible to confirm that all sampling locations (as presented in Figures 3-1 through 3-5) are positioned as proposed relative to mudline depths. Therefore, final determinations will be made in the field and may require the adjustment of proposed sampling locations (see also Section 4.1.3). Furthermore, sampling locations may require repositioning as a result of the presence of moored barges or other vessels that may be encountered during field sampling activities and that cannot be moved within a reasonable time frame.

Using the grid sampling design, a total of 301 locations will be sampled for surface (0 to 10 cm) sediment over all the defined river reaches and tidal zones. The nearshore (intertidal) and channel sideslope (shallow subtidal) samples will be collected along each shoreline at approximate 350-foot and 750-foot intervals, respectively. Within this grid, more focused sampling is also proposed for slips, sloughs, in the vicinity of existing and potential habitat restorations areas (e.g., the vicinity of Kellogg Island), the upper turning basin, and public access areas (e.g., the fishing pier at Terminal 105 and intertidal areas adjacent to residential communities). The channel (subtidal) samples will be collected at approximate 500-foot intervals in Reaches A and B and along 1,500-foot intervals in Reaches C and D. The more intensive sampling of the channel in the lower half of the study area is required to more fully characterize this portion of the navigation channel for which limited historical data are available. In contrast, only limited chemical characterization of the portion of the navigation channel in Reaches C and D is deemed necessary at this time as this area is scheduled to be investigated this summer by the Corps for maintenance dredging purposes. Overall, the nearshore and sideslope stations represent approximate 87 percent of the total number of locations to be sampled (64 and 23 percent, respectively), with the remaining 13 percent of stations designated within the channel.

Shallow subsurface sediment cores extending up to 4 feet (48 inches or 122 cm) below mudline will be collected at a subset (20 stations) of the surface sampling locations to allow for preliminary assessments of depth and volume of contaminated sediment within the study area. The subsurface sediment coring stations will be co-located with surface sediment samples and positioned at locations considered to potentially represent depositional areas (e.g., slips and sloughs) or areas of localized contamination (e.g., CSO and SD discharge areas and locations adjacent to more heavily industrialized upland properties). Composites representing the 0- to 2-foot and 2- to 4-foot depth horizons will be submitted for chemical and physical characterization.

Based on the most widespread contaminants of potential concern identified using historical data (see Section 2.2), all surface and subsurface sediment samples will be analyzed for Target Analyte List (TAL) metals, base-neutral and acid-extractable (BNA) organics and PCBs. The PCB analyses will include both Aroclors and congeners to satisfy HRS requirements and provide desired data for other agencies and interested parties. All surface and subsurface samples will also be analyzed for TOC and grain size, which may be used in the interpretation of data. For example, sediment concentrations for organics are typically normalized to total organic carbon

(TOC), while sediment concentrations for inorganics can be normalized to grain size or aluminum or iron concentrations.

Other potential contaminants of concern in river sediment (based on available historical information) include volatile organic compounds (VOCs), pesticides, dioxins/furans, and organotins. Because these contaminants do not appear to be as widespread at concentrations of concern, more limited sampling for these chemicals will be conducted, focusing primarily on providing generally equal areal coverage within all reaches. Overall, approximately 20 percent of the collected samples will be analyzed for VOCs (surface only) and pesticides (surface and co-located subsurface), 10 percent will be analyzed for dioxins/furans (surface only), and 40 percent will be analyzed for organotins (surface and co-located subsurface). Because organotins are of potential concern, the sampling approach also includes evaluating the potential bioavailability of organotins to aquatic receptors through the collection and analysis of sediment porewater. Additionally, the uncertainties associated with the bioavailability of metals potentially bound in sandblast grit or paint chips will be investigated as part of the porewater sampling program. The porewater sampling for organotins is focused in areas adjacent to shipyard facilities, marine ways, marinas, and slips; sediment sampling for organotins includes these areas, as well as locations providing generally equal areal coverage of each reach.

The specific sampling locations and analyses proposed for each river reach are discussed in detail in Section 3.2 below.

3.2 REACH-SPECIFIC SAMPLING LOCATIONS AND ANALYSES

3.2.1 River Reach A

3.2.1.1 Surface Sediment and Porewater Sampling

A total of 90 surface (0 to 10 cm) sediment stations will be sampled within the boundaries of Reach A (Figure 3-1), for a total of 95 surface sediment samples (includes five field duplicates). As described in Section 3.1, all samples will be analyzed for TAL metals, BNAs, PCBs (Aroclors and congeners), TOC, and grain size. In addition, surface sediments collected from 13 stations throughout the reach will be analyzed VOCs and pesticides, samples representing nine locations will be analyzed for dioxins/furans, and 27 stations located throughout the reach will be sampled for organotins. Additional sediment volume will be collected at three of these latter stations for porewater organotin and metals analyses. The three stations selected for porewater analyses are located adjacent to Harbor Island Marina, Birmingham Steel, and within Slip 1. Table 3-1 summarizes the proposed surface sediment and porewater chemical and physical analyses for Reach A.

3.2.1.2 Subsurface Sediment Sampling

Shallow subsurface (0 to 122 cm) sediment core samples will be collected from six of the surface sediment sampling stations within the boundaries of Reach A (Figure 3-1), for a total of 12 samples (two composite samples per Core). The coring stations are located adjacent to Birmingham Steel and the Alaska Marine Lines/Duwamish Shipyard facilities, the Diagonal Way South and Brandon Street CSOs/SDs, the mouth of Slip 1, and the eastern side of Kellogg Island. As described in Section 3.1, all core samples will be analyzed for TAL metals, BNAs, PCBs (Aroclors and congeners), TOC, and grain size. Consistent with the proposed co-located surface sediment chemical analyses, the core samples collected from three stations (six composites) will also be analyzed for pesticides, and all core samples will be analyzed for organotins. Table 3-1 summarizes the proposed subsurface sediment chemical and physical analyses for Reach A.

3.2.2 River Reach B

3.2.2.1 Surface Sediment and Porewater Sampling

A total of 81 surface (0 to 10 cm) sediment stations will be sampled within the boundaries of Reach B (Figure 3-2), for a total of 85 surface sediment samples (includes four field duplicates). As described in Section 3.1, all samples will be analyzed for TAL metals, BNAs, PCBs (Aroclors and congeners), TOC, and grain size. In addition, surface sediments collected from 11 stations throughout the reach will be analyzed VOCs and pesticides, samples representing 8 locations will be analyzed for dioxins/furans, and 24 stations located throughout the reach will be sampled for organotins. Additional sediment volume will be collected at five of these latter stations for porewater organotin and metals analyses. The five stations selected for porewater analyses are located within Slips 2 and 3, adjacent to the two marinas north of the First Avenue South Bridge (one on each shoreline), and near the Riverview Marina. Table 3-2 summarizes the proposed surface sediment and porewater chemical and physical analyses for Reach B.

3.2.2.2 Subsurface Sediment Sampling

Shallow subsurface (0 to 122 cm) sediment core samples will be collected from seven of the surface sediment sampling stations within the boundaries of Reach B (Figure 3-2), for a total of 16 samples (two composite samples per core plus two duplicate samples). The coring stations are located adjacent to the Lone Star NW, Port of Seattle Terminal 115 (Michigan SD), and Boyer Alaska Barge Lines properties, the mouths of Slips 2 and 3, the mouth of the slough into which the Second Avenue South SD discharges ("Trotsky" property), and the Fox Avenue South CSO/SD discharge area. As described in Section 3.1, all core samples will be analyzed for TAL metals, BNAs, PCBs (Aroclors and congeners), TOC, and grain size. Consistent with the proposed co-located surface sediment chemical analyses, the core samples collected from all but one of these stations will also be analyzed for pesticides, and all core samples will be analyzed for organotins. Table 3-2 summarizes the proposed subsurface sediment chemical and physical analyses for Reach B.

3.2.3 River Reach C

3.2.3.1 Surface Sediment and Porewater Sampling

A total of 64 surface (0 to 10 cm) sediment stations will be sampled within the boundaries of Reach C (Figure 3-3), for a total of 67 surface sediment samples (includes 3 field duplicates). As described in Section 3.1, all samples will be analyzed for TAL metals, BNAs, PCBs (Aroclors and congeners), TOC, and grain size. In addition, surface sediments collected from 10 stations throughout the reach will be analyzed VOCs and pesticides, samples representing six locations will be analyzed for dioxins/furans, and 20 stations located throughout the reach will be sampled for organotins. Additional sediment volume will be collected at two of these latter stations for porewater organotin and metals analyses. The two stations selected for porewater analyses are located within Slip 4 and adjacent to the South Park Marina. Table 3-3 summarizes the proposed surface sediment and porewater chemical and physical analyses for Reach C.

Of note, a subset of the intertidal samples designated to be collected along the portion of the western shoreline that bounds several residential properties (i.e., immediately downchannel of the 16th Avenue South bridge) may be collected within the upper intertidal zone (i.e., above +4 feet MLLW) to account for potential human health exposure pathways, such as children directly accessing the shoreline from adjacent homes. Final sampling elevations will be determined by the field coordinator at the time of sampling based on observed shoreline conditions.

3.2.3.2 Subsurface Sediment Sampling

Shallow subsurface (0 to 122 cm) sediment core samples will be collected from four of the surface sediment sampling stations within the boundaries of Reach C (Figure 3-3), for a total of eight samples (two composite samples per core). The coring stations are located adjacent to the Duwamish Waterway Park and South Park Marina/MCW DBA Duwamish Manufacturing properties, the mouth of Slip 4, and the Isaacson CSO/SD discharge area. As described in Section 3.1, all core samples will be analyzed for TAL metals, BNAs, PCBs (Aroclors and congeners), TOC, and grain size. Consistent with the proposed co-located surface sediment chemical analyses, the core samples collected from each of these stations will also be analyzed for pesticides and organotins. Table 3-3 summarizes the proposed subsurface sediment chemical and physical analyses for Reach C.

3.2.4 River Reach D

3.2.4.1 Surface Sediment and Porewater Sampling

A total of 61 surface (0 to 10 cm) sediment stations will be sampled within the boundaries of Reach D (Figure 3-4), for a total of 64 surface sediment samples (includes three field duplicates). As described in Section 3.1, all samples will be analyzed for TAL metals, BNAs, PCBs (Aroclors

and congeners), TOC, and grain size. In addition, surface sediments collected from nine stations throughout the reach will be analyzed VOCs and pesticides, samples representing six locations will be analyzed for dioxins/furans, and 19 stations located throughout the reach will be sampled for organotins. Additional sediment volume will be collected at three of these latter stations for porewater organotin and metals analyses. The three stations selected for porewater analyses are located within Slip 6 and adjacent to the Duwamish Yacht Club and Delta Marine properties. Table 3-4 summarizes the proposed surface sediment and porewater chemical and physical analyses for Reach D.

3.2.4.2 Subsurface Sediment Sampling

Shallow subsurface (0 to 122 cm) sediment core samples will be collected from three of the surface sediment sampling stations within the boundaries of Reach D (Figure 3-4), for a total of six samples (two composite samples per core). The coring stations are located adjacent to the Duwamish Yacht Club property (near the S. 96th Street SD), the mouth of Slip 6, and within the turning basin. As described in Section 3.1, all core samples will be analyzed for TAL metals, BNAs, PCBs (Aroclors and congeners), TOC, and grain size. Consistent with the proposed co-located surface sediment chemical analyses, the core samples collected from two stations will also be analyzed for pesticides, and all core samples will be analyzed for organotins. Table 3-4 summarizes the proposed subsurface sediment chemical and physical analyses for Reach D.

3.2.5 Background Reach

A total of five surface (0 to 10 cm) sediment stations will be sampled within the boundaries of the Background Reach (Figure 3-5), for a total of five background sediment samples. As described in Section 3.1, all samples will be analyzed for TAL metals, BNAs, PCBs (Aroclors and congeners), TOC, and grain size. In addition, all background surface sediment samples will be analyzed for VOC, pesticides, and organotins, and two of the proposed samples will also be analyzed for dioxins/furans. Additional sediment volume will be collected at two of the background stations (one intertidal and one subtidal location) for porewater organotin and metals analyses. Table 3-5 summarizes the proposed surface sediment and porewater chemical and physical analyses for the Background Reach.

SECTION 4

METHODS AND PROCEDURES

4.1 SAMPLING AND ANALYTICAL METHODS

4.1.1 Surface Sediment Sampling

Surface (0 to 10 cm) sediment for chemical testing will be collected in accordance with Puget Sound Estuary Program (PSEP) protocols (PSEP 1986 with updates). With the possible exception of a limited number of intertidal samples in the vicinity of South Park residences (see Section 3.2.3.1), all surface sediment samples will be collected using a modified 0.1 m² van Veen grab sampler. The sampler will be deployed from a sampling vessel of adequate size using a hydraulic winch system rigged to minimize the twisting forces on the sampler during deployment. The descent of the grab will be controlled by onboard personnel at a rate of approximately 1 ft/sec to minimize wake and probability of improper orientation upon contact with the bottom. Depth to sediment, station coordinates, and time will be recorded at the moment the grab sampling device contacts the bottom. The grab sampler will be retrieved at a rate of approximately 1 ft/sec to minimize potential disturbance of the sediment surface within the sampler.

Upon retrieval, the grab will be braced onboard in an upright position using wooden blocks. The access flaps will be opened and the overlying water will be slowly removed using a siphon. If excessive water leakage is evidenced by lack of an overlying water layer or excessive water turbidity is observed, the sample will be rejected prior to any additional characterization. For grab samples initially accepted based on minimal water leakage and turbidity, the condition of the collected sediment will be visually characterized per the following criteria to determine overall sample acceptability:

- Sediment is not pressed against the inside top of or extruding from the sampler.
- Sediment surface appears to be relatively undisturbed (i.e., flat with minimal winnowing).
- Minimum penetration depths are achieved:

Medium-coarse sand—4 to 5 cm

Fine sand—6 to 7 cm

Silts/clays—10 cm

Samples that do not meet any one of the above criteria will be rejected and the station will be re-sampled. Locations at which a 10-cm penetration depth cannot be consistently obtained due to

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the physical characteristics of the sediment will be represented by the maximum obtainable depth. Corrective actions that may be employed in the field to address potential sampler overfilling or consistent under-penetration include the removal or addition of weights or buoys to the van Veen to address these problems. After a grab sample is deemed acceptable, the following observations will be recorded on the field sample record forms (see Section 4.3):

- Sediment penetration depth (nearest 0.5 cm) based on sediment depth at the center of the grab.
- Physical characteristics of the surface sediment, including color, texture, presence of anthropogenic material, and presence and type of biological structures, other debris, sheens, or odors.
- Physical characteristics of the vertical profile, including changes in sediment characteristics and presence and depth of potential redox layers.

Sediment will be removed from the van Veen grab sampler using decontaminated stainless-steel spoons or trowels, placed in stainless-steel bowls or soup pots, and homogenized using a stainless-steel spool or power drill fitted with a stainless-steel mixing paddle (the latter will be necessary at porewater stations because of the relatively large volumes of sediment requiring homogenization for chemical analyses). All subsamples for laboratory analysis will be placed in labeled, laboratory-cleaned sample jars. Care will be taken to ensure that sediment in contact with the inside of the van Veen, as well as any large items of debris, are excluded from the samples for laboratory analysis.

In the event that a subset of the proposed intertidal stations cannot be collected using a van Veen grab (e.g., those areas inaccessible due to sampling vessel draft or mast-height constraints, or areas in the vicinity of the South Park residential community at which upper intertidal sampling may be desired), samples will be collected by hand using stainless-steel hand-corers, spoons, or trowels. Samples will be collected at 10-cm depths and the sample documentation, homogenization, and chemical subsampling techniques described above will be followed for the hand-collected samples.

At stations at which sediment will be collected for bulk sediment chemistry and conventionals, and porewater for both organotins and metals analyses, approximately four acceptable van Veen grabs (or about 8 liters of sediment) are anticipated to be required. This assumption is based on a collection volume of approximately 2 liters of sediment per grab, with 2 liters required for bulk sediment analyses and 6 liters of sediment required to obtain 1.5 liters of porewater (as a conservative estimate, porewater is assumed to constitute only 25 percent of the sediment volume). The number of van Veen grabs will be adjusted upward if, as previously described, consistent 10-cm grabs cannot be attained due to substrate composition. If samples are collected by hand, multiple hand-cores or scoops will be collected to ensure sufficient sediment volume is available for bulk sediment and porewater analyses. In addition, these samples will be collected

at or directly below (hand-cores only) the waterline to ensure the collection of water-saturated sediments.

4.1.2 Subsurface Sediment Sampling

It is currently anticipated that the subsurface sediment coring activities will be conducted using a 3-inch-diameter gravity corer. The gravity corer will be configured with a core barrel capable of recovering 4-foot cores and will weigh about 500 pounds when empty. The sampler will be deployed from a sampling vessel of adequate size using a hydraulic winch system rigged with swivel tackle to minimize the twisting forces on the sampler during deployment. Once the sampler is deployed, a winch capable of lifting approximately 2,500 pounds will be required to overcome the weight of the sediment in the sampler and the friction exerted on the sides of the core barrel.

The descent of the gravity corer will be controlled by an onboard winch operator at a rate of approximately 1 ft/sec to minimize wake and probability of improper orientation upon contact with the bottom. Depth to sediment, station coordinates, and time will be recorded at the moment the gravity core sampling device contacts the bottom. The gravity corer will be retrieved at a rate of approximately 1 ft/sec to preserve the integrity of the sample (i.e., minimize the potential for washout).

Upon retrieval, the gravity core will be braced horizontally onboard by field personnel and stabilized with wooden blocks. The nosepiece and eggshell core catcher will be removed, a section of foil will be placed over the exposed sediment surface at the bottom of the core liner and a polyethylene cap will be placed over the foil and secured with tape. The acetate core liner will then be removed from the core barrel and raised vertically with the bottom-side-down. A second section of foil and a polyethylene cap will be secured over the top of the core liner and the station number will be written on both the top of the cap and the side of the liner. Any overlying water will be drained by drilling a hole in the core liner slightly above the sediment/water interface. The depth to sediment from the top of the coring tube will be measured and recorded. Collected cores will be fixed vertically to a secured point on the sampling vessel (e.g., a railing or bulkhead) with heavy gauge rope for temporary storage until processing.

Core processing will be conducted either onboard the sampling vessel or at an onshore location with adequate facilities. Sediment from each core will be extruded onto a decontaminated 4-foot (minimum length) stainless-steel tray by elevating the tube at an angle. If sediment is seized within the liner due to over-compaction and/or coarse grain size, the liner will be tapped with a rubber mallet to loosen the sediment from the core liner. Care will be taken to ensure that samples are extruded as slowly as possible to maintain the cylindrical form of the core. Once the core sediment is extruded onto the tray, the following observations will be recorded on the field sample record forms (see Section 4.3):

- Physical characteristics of the subsurface sediment, including color, texture, presence of anthropogenic material, and presence and type of biological structures, other debris, sheens, or odors.
- Physical characteristics of the vertical profile, including changes in sediment characteristics and presence and depth of potential redox layers.

Sediment will be removed from the stainless steel tray using decontaminated stainless-steel spoons or trowels, placed in a stainless-steel container, and homogenized. All samples will be placed in labeled, laboratory-cleaned sample jars. Care will be taken to ensure that any large items of debris are excluded from all samples.

Sediment composited from the 0- to 2-foot (0- to 61-cm) and 2- to 4-foot (61- to 122-cm) intervals will be analyzed for bulk sediment chemistry per Section 3, and conventionals, which will require approximately 2 liters of sediment. It is anticipated that only one core will be required to be collected at each station to meet this volume requirement, as 2 feet of sediment in a 3-inch-diameter core provides approximately 3.7 liters of sediment.

It should be noted that gravity corers may experience difficulty penetrating coarser sediment (e.g., sand). In the event that insufficient penetration or core washout is consistently encountered during the coring program, alternative core sampling techniques (e.g., using 2-inch-diameter cores) or devices (e.g., piston corer) may be required. The use of alternative techniques or devices will be discussed with the EPA Site Assessment Manager (SAM) prior to implementation in the field and will subsequently be documented as part of the SI report. If the use of such methods still results in only limited penetration or recovery, then the proposed core composite intervals for chemical analyses may be adjusted downward (e.g., 0 to 1.5 feet and 1.5 to 3 feet). This type of contingency action would also be discussed with the EPA SAM prior to implementation in the field.

4.1.3 Station Positioning Requirements

A differential global positioning system (DGPS) is the preferred surveying system for samples collected from a sampling vessel. The DGPS consists of a GPS receiver mounted at a fixed point (e.g., top of A-frame or sampling platform) on the vessel and a differential receiver located at a horizontal control point. At the control point, the GPS position is compared to the known horizontal location. Offsets or biases are identified and used to develop correction factors, which are sent to the GPS receiver located on the vessel. DGPS is typically accurate to within 1 to 3 meters, depending on satellite position. The GPS provides the operator with a listing of time intervals during the day when accuracies are decreased, so these periods can be avoided, if possible.

The exact locations of the proposed sampling locations will be determined in the field based on visual markers (e.g., shoreline features) and depth to bottom (for targeting sideslope and channel

stations), which will be measured using an onboard fathometer. Bottom depths will be tidally corrected in the field. Once “on-station,” the DGPS will be used to record actual station positions. It is anticipated that these data will be reported as latitude and longitude (WGS-84).

4.2 SAMPLE HANDLING, PACKAGING, AND SHIPMENT

4.2.1 Sample Containers

To preserve sample integrity, proper sample containers will be used for parameters designated in this program. Precleaned sample containers will be obtained from the analytical laboratory or a scientific supply vendor. Containers will be precleaned per the requirements in EPA guidance documents (EPA 1989).

Container requirements vary according to analyte, sample matrix, and hazard classification. It is anticipated that samples collected for the project will be low hazard. Table 4-1 summarizes the type and number of sample containers required for the sampling program.

4.2.2 Sample Packaging

Custody seals and completed EPA sample tags will be placed on each sample container. Sample containers will then be placed in a resealable plastic bag and placed in an appropriate shipping container (steel-belted cooler) lined with a polyethylene bag. Sufficient vermiculite will be added to prevent breakage of sample containers and to absorb spills in the event of breakage. Double-bagged ice will be placed on top of the vermiculite if cooling is required for sample preservation. The polyethylene bag will then be twisted shut and secured. Region X Field Sample Data Sheets, Chain-of-Custody forms, Contract Laboratory Program (CLP) Traffic Report forms, and/or any other pertinent sample documentation will be placed in a resealable plastic bag and taped to the inside cover of the cooler. Custody seals will be placed on the front and back of the cooler, and the cooler will be taped shut.

4.2.3 Sample Shipment

Shipping and handling of samples will be done in a manner that protects both the sample integrity and shipment handlers from the possible hazardous nature of the samples. Samples will be shipped by Federal Express Priority One air service. Packaging, marking, labeling, and shipping of samples will comply with regulations promulgated by the International Air Transport Association regulations. Detailed requirements are discussed in the CLP User's Guide (EPA 1991).

4.3 DOCUMENTATION

4.3.1 Field Documentation

All pertinent field information will be recorded in ink in a bound logbook. At a minimum, the following information will be recorded in the daily logbook:

- Date and time of entry (24-hour clock)
- Project name and location
- Project number
- Time and duration of daily sampling activities
- Weather conditions
- Variations, if any, from required sampling protocols and reasons for deviations
- Name of person making field entries and other field personnel
- On-site visitors, if any
- General methods of sample collection
- Levels of personal protection
- Any other observations useful in reconstructing field activities.

Field sample records specific to each type of sampling activity will also be maintained by field personnel. Example sediment collection field forms are provided in Appendix B. Additional information that will be documented on these field sample records includes sample numbers and station identifiers, and for sediment collected from a sampling vessel, the name of the sampling vessel and subcontractor, actual sample coordinates, tidal information, the depth to sediment (i.e., water depths and tidally corrected mudline elevations), and the observations described in Sections 4.1.1 and 4.1.2.

Sample documentation forms for laboratory analyses will be obtained through the EPA Regional Sample Control Coordinator (RSCC).

4.3.2 Sample Designation and Labeling

All samples collected will be assigned a unique WESTON identification code based on a sample designation scheme designed to suit the needs of the field staff, data management, and data users.

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All sample identifiers will consist of three components separated by dashes. These components are media type, unique location code, and sample type. The sample designation scheme is as follows:

Media Type		Location Code		Sample Type
mm	-	DRsss	-	t ddd [i]

The three components are further described in the following sections.

4.3.2.1 Media Type

Media type is a two-character code that defines the type of medium sampled. The media codes designated for this project are as follows:

SD	-	Sediment
PW	-	Porewater (Note: Porewater will be extracted from surface sediments by the contracted laboratory, but the sediments designated for extraction will be assigned the "PW" media code in the field.)

4.3.2.2 Location Code

The location identification code is a 5-character code (aaxxx) that denotes both a general and unique location. The first two (alpha) characters assigned for this investigation are DR for Duwamish River. The second three (numeric) characters will be a series of sequential numbers denoting a unique location in the river.

4.3.2.3 Sample Type

The sample type component has the following three parts:

The single character "t" indicates a sample type having one of the following two values:

0	-	Field sample
1	-	Field duplicate

The three-character "ddd" is a depth indicator, where the sample collection depth is represented by the top of the sampling interval in tenths of feet. For example, if the top of the sampling interval is at 0 feet (e.g., a surface sample), then this component is represented by "000." If the top of the sampling interval begins at 1.5 feet below mudline (e.g., a core composite), then this component is represented by "015."

The optional “i” field is a single-digit component that will be used for sediment core samples collected from the same station as surface (0 to 10 cm) sediments and representative of surface conditions (i.e., where the sample depth field “ddd” for both sample types is “000” based on top of sampling interval). The letter “A” will be assigned to core samples representing the top interval sampled (e.g., 0 to 2 feet).

Examples

Examples of complete sample numbers with descriptions are as follows:

SD-DR004-0000: A surface (0 to 10 cm) sediment sample collected from Station DR004.

SD-DR117-1000: A duplicate surface (0 to 10 cm) sediment sample collected from Station DR117.

PW-DR020-0000: A surface (0 to 10 cm) sediment sample collected from Station DR020 and designated for porewater extraction.

SD-DR278-0000A: A co-located subsurface sediment sample collected from Station DR278, with the top of the composite interval at 0 feet.

SD-DR278-0020: A subsurface sediment sample collected from Station DR278, with the top of the composite interval at 2 feet below mudline.

4.3.3 Chain-of-Custody Procedures

Sample custody is a critical aspect of environmental investigations, particularly when the data may be used in litigation. The possession and proper handling of samples must be traceable from the time the samples are collected until the data have been accepted for analysis so that re-analyses may be conducted without concern for possible introduction of contaminants.

The purpose of custody procedures is to provide a documented, legally defensible record that can be used to follow the possession and handling of a sample from collection through analysis. A sample is in custody if it is:

- In someone's physical possession or view, and/or
- Secured to prevent tampering, and/or
- Secured in an area restricted to authorized personnel.

4.3.3.1 Field Custody Procedures

Sample control and chain-of-custody procedures in the field and during shipment will be performed in accordance with the procedures in the CLP User's Guide (EPA 1991).

Each sample will be assigned a unique identifying number. Labels will be filled out in waterproof ink prior to sample collection to minimize container handling. Sample label and chain-of-custody forms will include the following information:

- Name of sampler
- Date and time of sample collection
- Sample number
- Sample matrix and how collected (i.e., grab, composite)
- Preservation method
- Analyses required

Sample documentation forms for laboratory analyses will be obtained through the EPA Region Sample Control Center (RSCC). Examples of sample documentation forms were previously provided in Appendix B of the QAPP (WESTON 1994a). Internal WESTON sample names will not be placed on the chain of custody or sample bottles.

4.3.3.2 Laboratory Custody Procedures

Laboratories supporting this project shall have custody procedures commensurate with the EPA Region X Manchester Laboratory SOP, the EPA Contract Laboratory Program Statement of Work (CLP SOW), or Special Analytical Services Basic Ordering Agreement (SAS BOA). These procedures document and describe the acceptance, internal transfer, and final reporting of samples.

4.4 EQUIPMENT DECONTAMINATION

Equipment decontamination will be required to prevent contamination of clean areas and cross-contamination of samples, and to maintain the health and safety of field personnel. Decontamination of all sampling equipment will be required.

Dedicated or disposable sampling equipment will be used when feasible to reduce the possibility of sample cross-contamination. WESTON will attempt to have sufficient sampling equipment available to allow for decontamination at the end of each day rather than between individual

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samples; however, some equipment, such as the van Veen grab sampler, will require decontamination between each sampling location. Equipment that cannot be effectively decontaminated (e.g., siphon tubing) will be disposed of after each sampling event. Equipment that is likely to require field decontamination includes, but is not limited to:

- Stainless-steel trowels and spoons
- Stainless-steel mixing bowls and soup pots
- van Veen grab sampler
- Acetate core liners
- Stainless-steel mixing paddle

The field decontamination procedure for sampling equipment such as those items listed above will consist of the following steps:

1. Liquinox detergent wash (or some other non-phosphate detergent)
2. Tap or seawater rinse
3. Solvent (acetone) rinse (small sampling items and utensils only)
4. Deionized water rinse
5. Air dry, if possible, away from potential sources of contamination (e.g., splashes)
6. Wrap or cover in aluminum foil (shiny side out)
7. Store in plastic bags (when possible)

4.5 INVESTIGATION-DERIVED WASTE

All efforts will be made to minimize investigation-derived waste (IDW) that cannot be disposed of as solid waste. Disposal of personal protective equipment and disposable sampling equipment will be double-bagged and treated as solid waste. Decontamination water containing methanol and hexane will be considered hazardous waste. To minimize generation of hazardous decontamination water, it will be used sparingly and separated from nonhazardous decontamination water (e.g., containing only Liquinox). All hazardous IDW will be handled and disposed of in an EPA-approved manner.

SECTION 5

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Field and laboratory quality assurance/quality control (QA/QC) will be based on the EPA-approved QAPP (WESTON 1994a).

5.1 FIELD QA/QC SAMPLES

Field QC samples will consist of sample duplicates. Field duplicate samples are designed to monitor overall sampling and analytical precision. Blind field duplicates will consist of a homogenized sample that is split into two sample aliquots. Field duplicate frequency will be five percent of each matrix collected or once per sampling event, whichever is more frequent. Samples will be assigned unique numbers and will not be identified as duplicates to the laboratory. Table 5-1 presents field QA/QC samples to be collected.

5.2 LABORATORY QA/QC SAMPLES

The quality of analytical data is controlled by the frequency and type of internal quality control checks developed for each analysis type. Laboratory results will be evaluated by reviewing results for analysis of method blanks, matrix spikes, duplicate samples, laboratory control samples, calibrations, performance evaluation samples, interference checks, etc., as specified in analytical methods.

5.2.1 Method Blanks

Method blanks usually consist of laboratory reagent-grade water treated in the same manner as the sample (e.g., digested, extracted, distilled, etc.) then analyzed and reported as a standard sample. The analysis of method blanks serves as a check on reagents and equipment to ensure that they are contaminant-free.

5.2.2 Surrogate Compound Recovery

Surrogate compounds are organic compounds similar to the analytes of interest in chemical composition, extraction and chromatographic properties, but are not normally found in environmental samples. These compounds are spiked into laboratory samples for VOC, BNA, and PCB analyses. Percent recoveries are calculated for each surrogate compound in each sample. These recoveries give an indication of the accuracy of the analytical method.

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5.2.3 Matrix Spikes

A matrix spike is an aliquot of a field sample that is fortified (spiked) with the analytes of interest and analyzed with an associated sample batch to monitor the effects of the field sample matrix (matrix effects) on the analytical method.

Samples for matrix spike and matrix spike duplicate analysis will be designated by the WESTON field coordinator. QC samples will be selected based on visual and field monitoring results. An effort will be made to ensure that QC samples are representative of the samples analyzed (i.e., the most contaminated or cleanest samples will not be selected).

5.2.4 Laboratory Duplicate Samples

Duplicate samples are obtained by splitting a field sample into two separate aliquots in the laboratory and performing two separate analyses on the aliquots. The analysis of laboratory duplicates monitors sample precision.

Samples for laboratory duplicate analysis will be designated by the WESTON field coordinator. QC samples will be selected based on visual and field monitoring results. An effort will be made to ensure that QC samples are representative of the samples analyzed (i.e., the most contaminated or cleanest samples will not be selected).

5.2.5 Laboratory Control Samples

A laboratory control sample is identified to the analyst so that it is used to check the accuracy of an analytical procedure. It is particularly applicable when a minor revision or adjustment has been made to the analytical procedure or instrument. Known samples are usually analyzed along with blind samples to monitor performance. Continuing calibration verification analysis may be used as a laboratory control when specified by the analytical method.

5.3 QUANTITATION LIMITS

Quantitation limit goals for the sediment and porewater sampling events are presented in Tables 5-2 and 5-3, respectively. Actual analyte detection limits are matrix- and sample-dependent and may be higher depending upon sample moisture content, analytical interferences, and any required sample dilutions. The laboratories will make best efforts to achieve quantitation limit goals. Additional sample cleanup steps or method modifications may be required in some cases. The quantitation limits were selected to ensure that data could be directly compared with available sediment and porewater chemical screening values, if desired.

SECTION 6

HEALTH AND SAFETY

Prior to beginning field work for this project, a detailed project-specific Health and Safety Plan (HASP) will be prepared by WESTON. This plan will detail all the chemical, physical, and biological hazards that may be encountered while on-site performing the tasks outlined in this plan along with specific responses necessary to avoid or minimize impacts should an exposure to a hazard occur.

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SECTION 7

SCHEDULE

Figure 7-1 provides the schedule for the Duwamish River SI.

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SECTION 8

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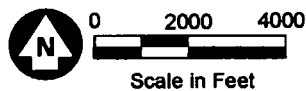
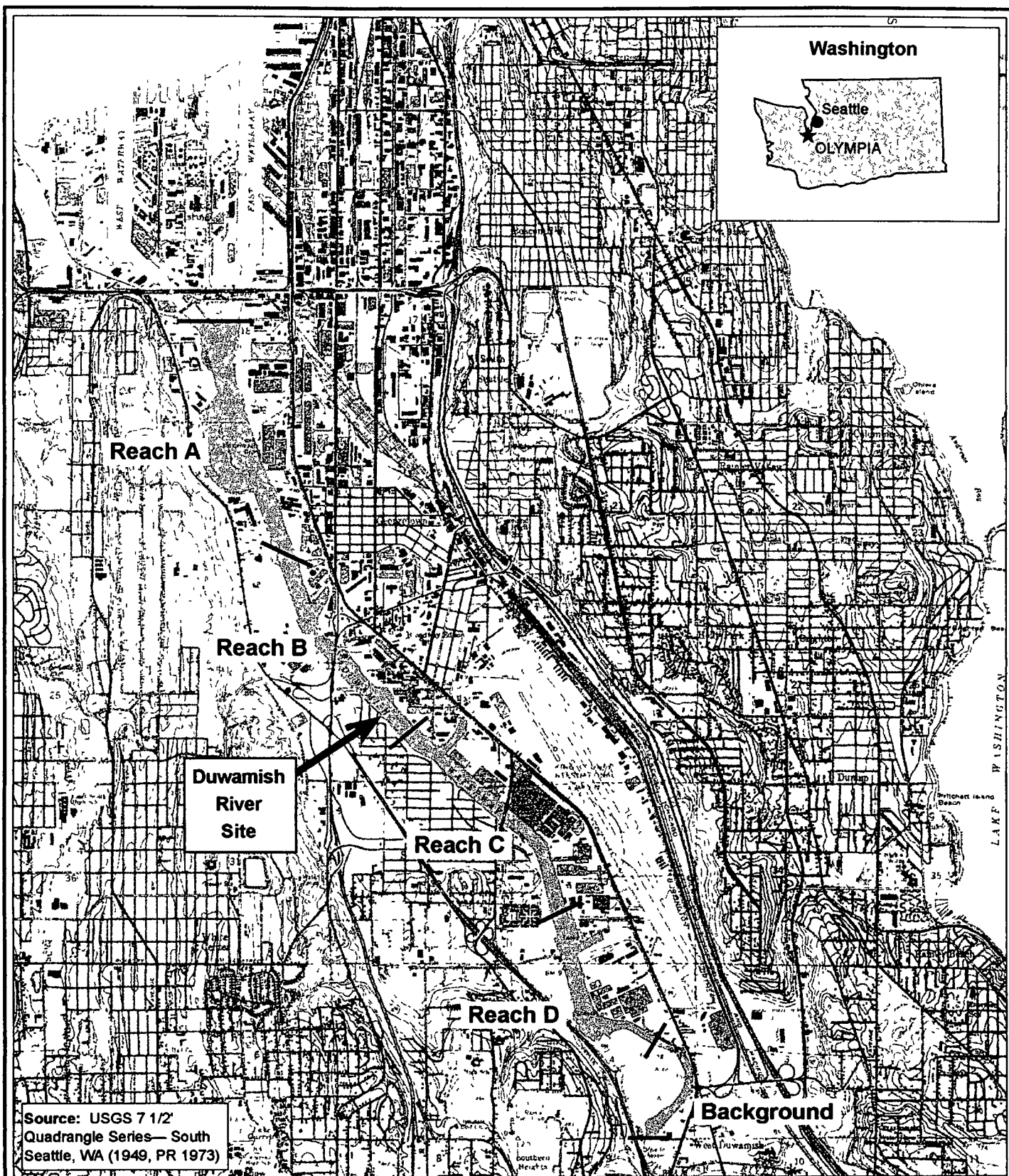
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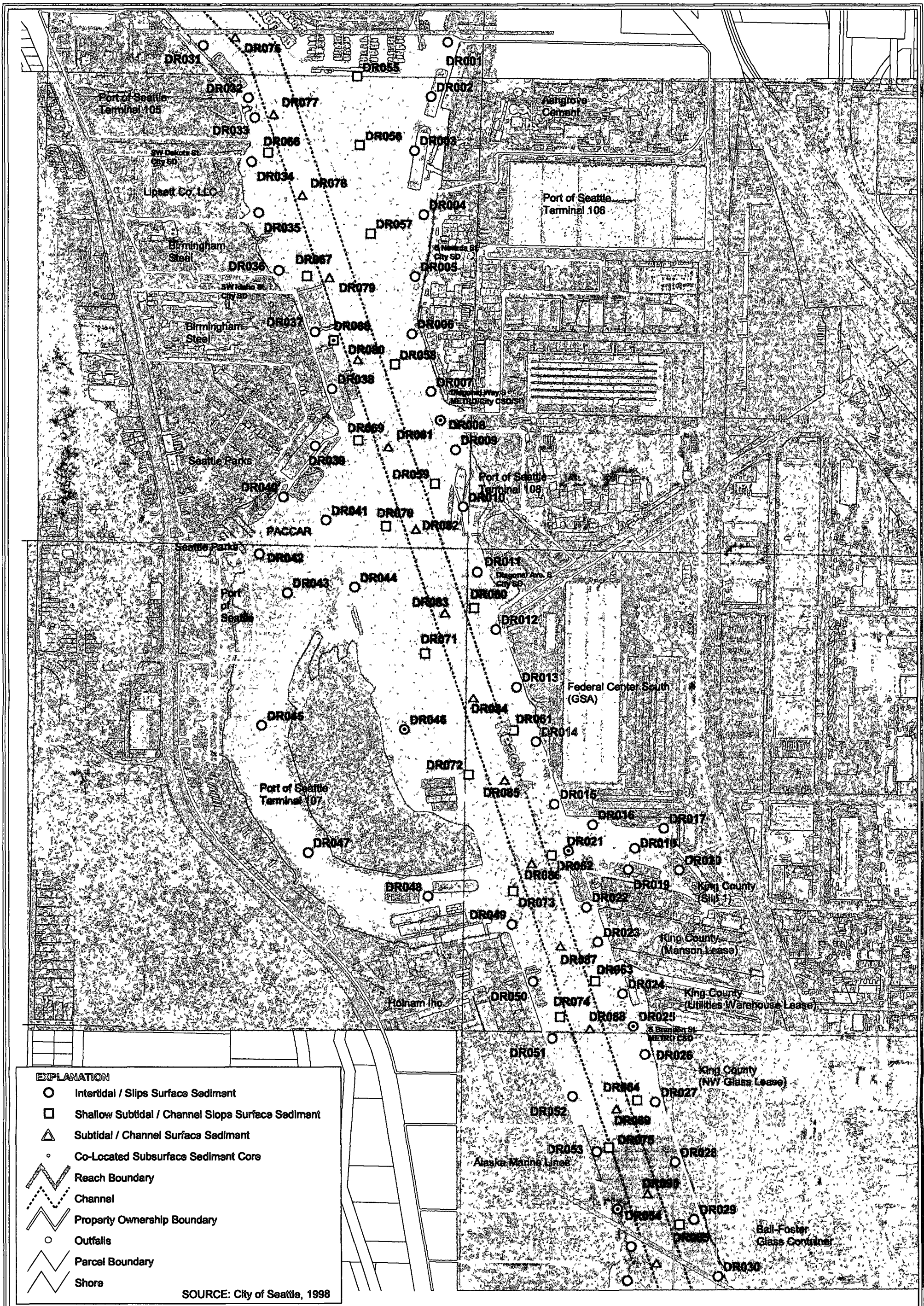
FIGURES



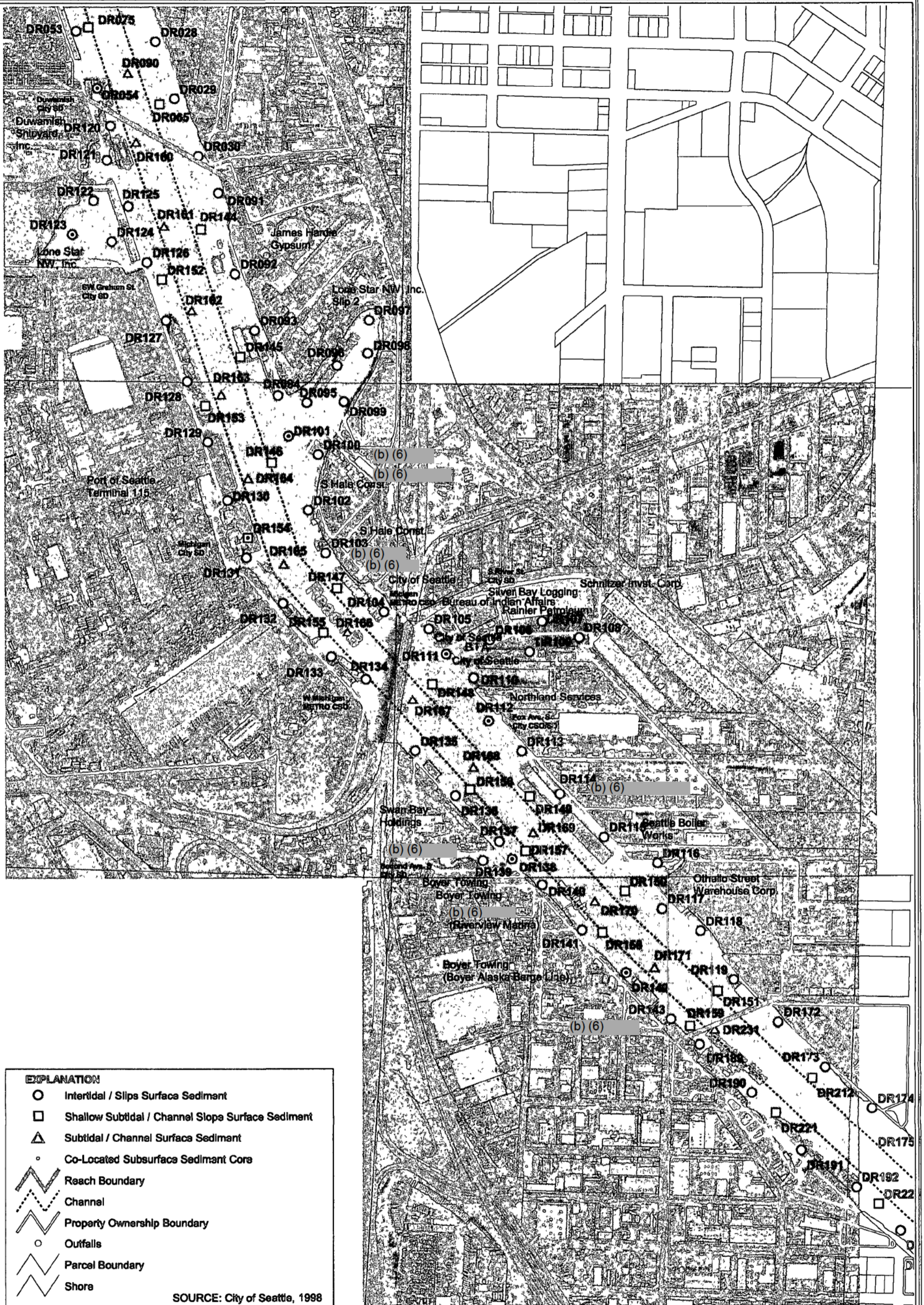
WESTON
MANAGER DESIGNERS/CONSULTANTS

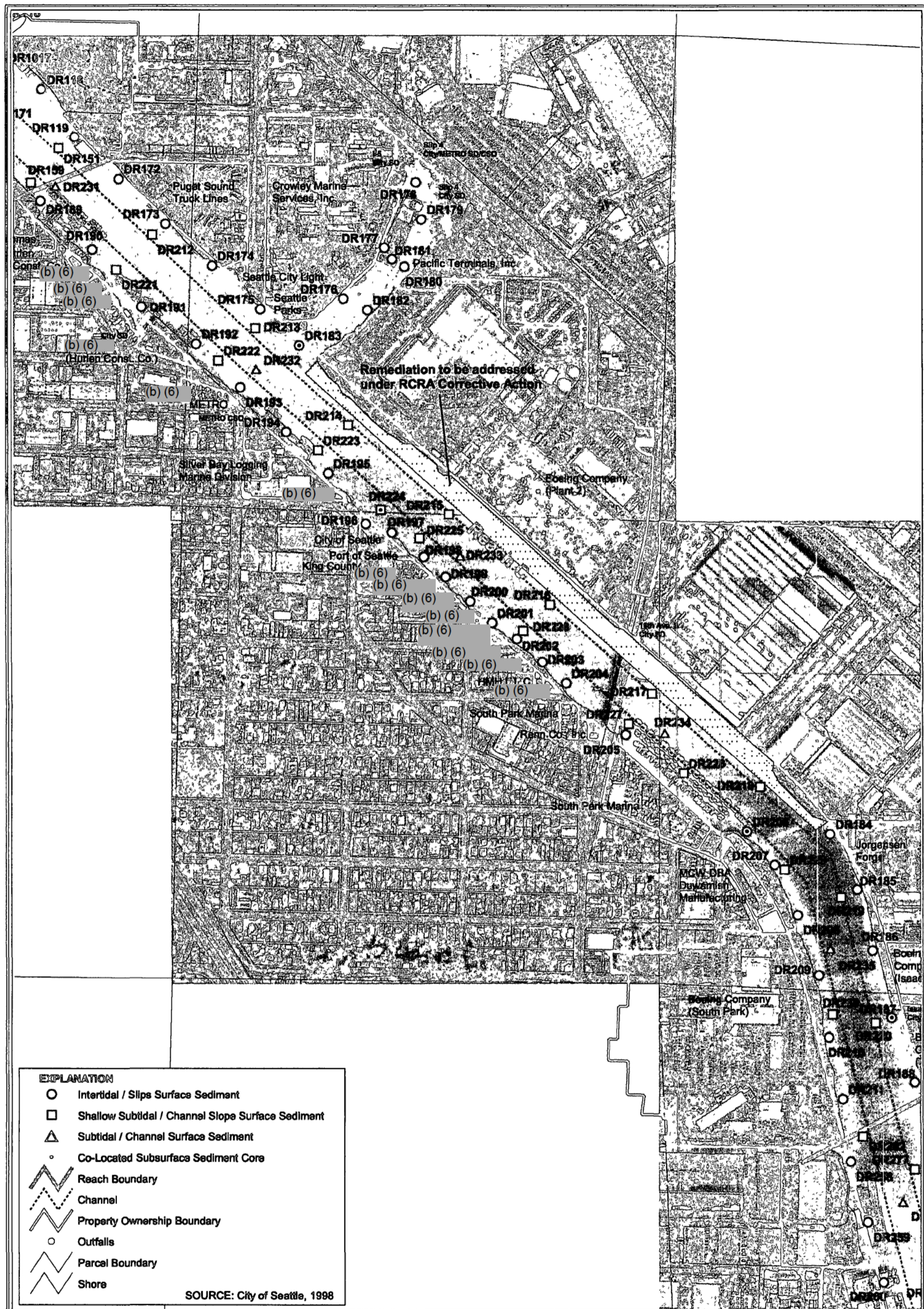
Duwamish River Site Inspection Vicinity Map and Reach Locations

FIGURE
1-1

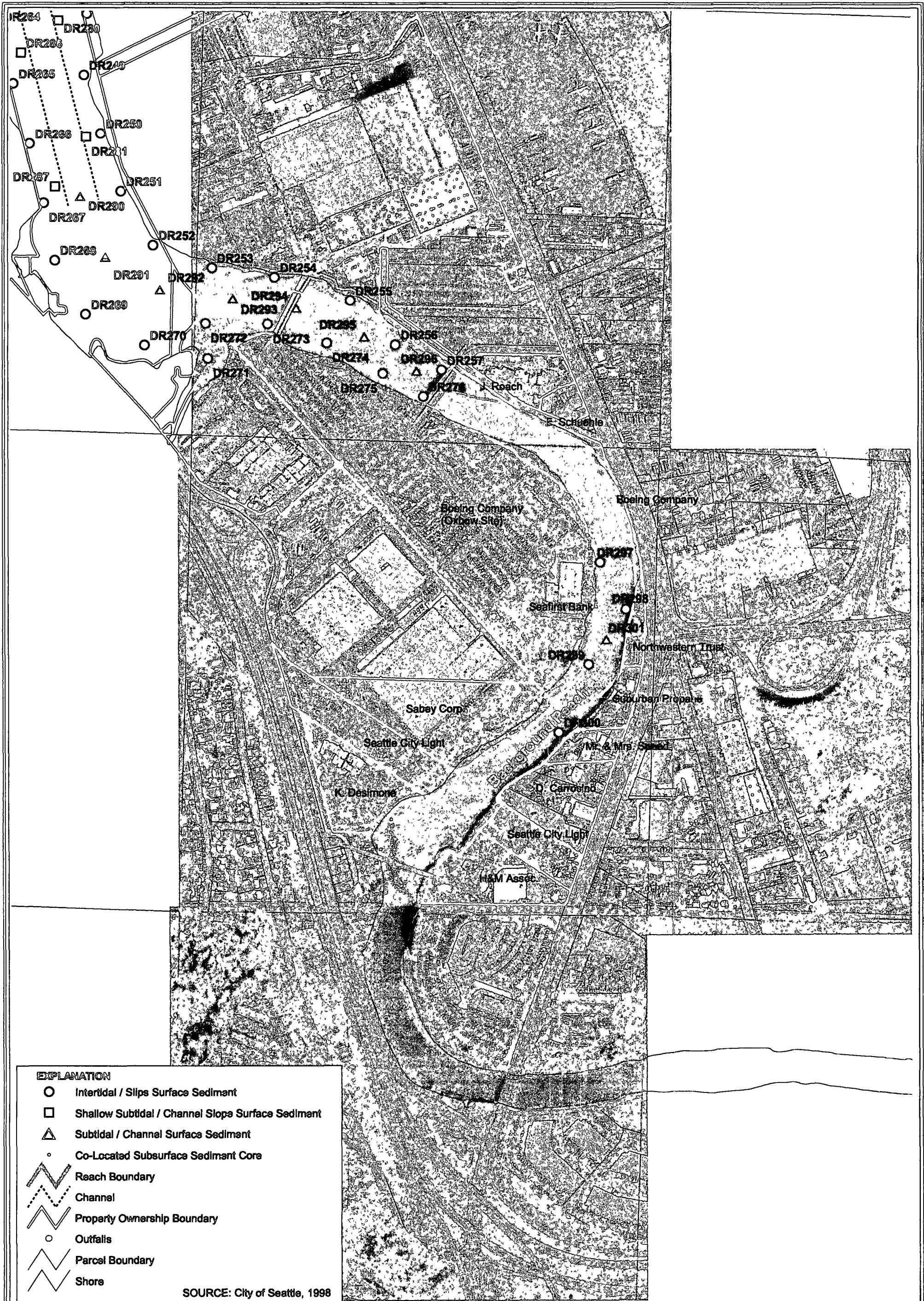


Duwamish River SI - Reach A
Proposed Sampling Locations





Duwamish River SI - Reach C
Proposed Sampling Locations



100 0 100 200 Feet

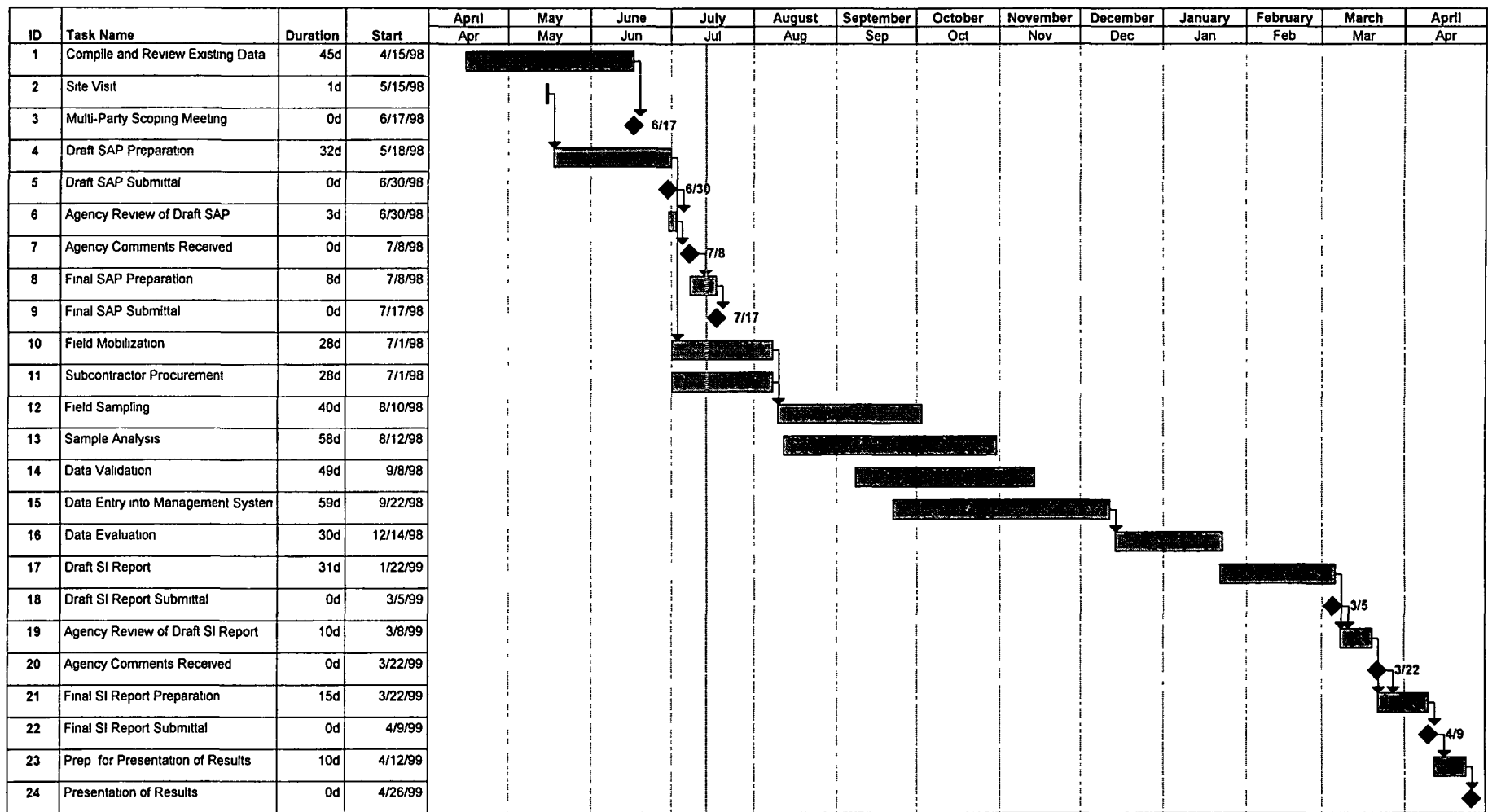
WESTON
MANAGERS ENGINEERS ARCHITECTS

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Duwamish River SI - Background Reach
Proposed Sampling Locations

FIGURE

3-5



Task  Milestone 
Progress  Summary 

Rolled Up Task  Rolled Up Progress 
Rolled Up Milestone 

Project Schedule



FIGURE
7-1

TABLES

Table 3-1—Reach A Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
Surface Sediment												
SD-DR001-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR002-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X	X	X	X
SD-DR003-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR004-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR004-1000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR005-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR006-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR007-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR008-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X	X	X	X
SD-DR009-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR010-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR011-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR012-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR013-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR014-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR015-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR016-0000	0 - 10 cm	Slip 1	X	X	X	X					X	X
SD-DR017-0000	0 - 10 cm	Slip 1	X	X	X	X					X	X
SD-DR018-0000	0 - 10 cm	Slip 1	X	X	X	X			X		X	X
SD-DR019-0000	0 - 10 cm	Slip 1	X	X	X	X					X	X
SD-DR020-0000	0 - 10 cm	Slip 1	X	X	X	X					X	X
SD-DR021-0000	0 - 10 cm	Slip 1	X	X	X	X	X	X	X	X	X	X
SD-DR022-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR022-1000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR023-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR024-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR025-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR026-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR027-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR028-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR029-0000	0 - 10 cm	Intertidal	X	X	X	X			X	X	X	X

Table 3-1—Reach A Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
SD-DR030-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR031-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR032-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR033-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X	X	X	X
SD-DR034-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR035-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR036-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR037-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR038-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR039-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR040-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR041-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR042-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X	X	X	X
SD-DR043-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR044-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR045-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR045-1000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR046-0000	0 - 10 cm	Intertidal	X	X	X	X			X	X	X	X
SD-DR047-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X	X	X	X
SD-DR048-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR049-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR050-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR051-0000	0 - 10 cm	Intertidal	X	X	X	X			X	X	X	X
SD-DR052-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR053-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR053-1000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR054-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR055-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X			X		X	X
SD-DR056-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X			X		X	X
SD-DR057-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR058-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR059-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR060-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X

Table 3-1—Reach A Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
SD-DR061-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR062-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR063-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR064-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR065-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR066-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR067-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X	X	X	X		X	X
SD-DR068-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X			X		X	X
SD-DR069-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR069-1000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR070-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X			X		X	X
SD-DR071-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR072-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X			X		X	X
SD-DR073-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR074-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR075-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR076-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR077-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR078-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR079-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR080-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR081-0000	0 - 10 cm	Channel	X	X	X	X	X	X	X		X	X
SD-DR082-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR083-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR084-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR085-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR086-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR087-0000	0 - 10 cm	Channel	X	X	X	X	X	X	X		X	X
SD-DR088-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR089-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR090-0000	0 - 10 cm	Channel	X	X	X	X			X		X	X

Table 3-1—Reach A Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
Subsurface Sediment												
SD-DR008-0000A	0 - 2 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR008-0020	2 - 4 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR021-0000A	0 - 2 ft	Slip 1	X	X	X	X		X	X		X	X
SD-DR021-0020	2 - 4 ft	Slip 1	X	X	X	X		X	X		X	X
SD-DR025-0000A	0 - 2 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR025-0020	2 - 4 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR046-0000A	0 - 2 ft	Intertidal	X	X	X	X			X		X	X
SD-DR046-0020	2 - 4 ft	Intertidal	X	X	X	X			X		X	X
SD-DR054-0000A	0 - 2 ft	Intertidal	X	X	X	X			X		X	X
SD-DR054-0020	2 - 4 ft	Intertidal	X	X	X	X			X		X	X
SD-DR068-0000A	0 - 2 ft	Shallow Subtidal	X	X	X	X			X		X	X
SD-DR068-0020	2 - 4 ft	Shallow Subtidal	X	X	X	X			X		X	X
Sediment Porewater												
PW-DR018-0000	0 - 10 cm ^a	Slip 1	X						X			
PW-DR038-0000	0 - 10 cm ^a	Intertidal	X						X			
PW-DR055-0000	0 - 10 cm ^a	Shallow Subtidal	X						X			
Total No. of Sediment Sample Analyses			107	107	107	107	14	20	40	9	107	107
Total No. of Porewater Sample Analyses			3						3			

^aSediment sampling depth from which porewater will be extracted

Table 3-2—Reach B Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
Surface Sediment												
SD-DR091-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR092-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X	X	X	X
SD-DR092-1000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR093-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR094-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR095-0000	0 - 10 cm	Slip 2	X	X	X	X					X	X
SD-DR096-0000	0 - 10 cm	Slip 2	X	X	X	X			X		X	X
SD-DR097-0000	0 - 10 cm	Slip 2	X	X	X	X					X	X
SD-DR098-0000	0 - 10 cm	Slip 2	X	X	X	X					X	X
SD-DR099-0000	0 - 10 cm	Slip 2	X	X	X	X					X	X
SD-DR100-0000	0 - 10 cm	Slip 2	X	X	X	X					X	X
SD-DR101-0000	0 - 10 cm	Slip 2	X	X	X	X	X	X	X	X	X	X
SD-DR102-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR103-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR104-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR105-0000	0 - 10 cm	Slip 3	X	X	X	X					X	X
SD-DR106-0000	0 - 10 cm	Slip 3	X	X	X	X					X	X
SD-DR107-0000	0 - 10 cm	Slip 3	X	X	X	X					X	X
SD-DR108-0000	0 - 10 cm	Slip 3	X	X	X	X					X	X
SD-DR109-0000	0 - 10 cm	Slip 3	X	X	X	X			X		X	X
SD-DR110-0000	0 - 10 cm	Slip 3	X	X	X	X			X		X	X
SD-DR111-0000	0 - 10 cm	Slip 3	X	X	X	X	X	X	X	X	X	X
SD-DR112-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR113-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR113-1000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR114-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR115-0000	0 - 10 cm	Intertidal	X	X	X	X			X	X	X	X
SD-DR116-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR117-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR118-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR119-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X

Table 3-2—Reach B Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
SD-DR120-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR121-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR122-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR123-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X	X	X	X
SD-DR124-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR125-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR126-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR127-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR128-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR129-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR130-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR131-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR131-1000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR132-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR133-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR134-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR135-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR136-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR137-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR138-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR139-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR140-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR141-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR141-1000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR142-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X	X	X	X
SD-DR143-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR144-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR145-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR146-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR147-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X			X		X	X
SD-DR148-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR149-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR150-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X

Table 3-2—Reach B Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
SD-DR151-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X			X		X	X
SD-DR152-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X	X	X	X		X	X
SD-DR153-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR154-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X	X	X	X	X	X	X
SD-DR155-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR156-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR157-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR158-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR159-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR160-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR161-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR162-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR163-0000	0 - 10 cm	Channel	X	X	X	X	X	X	X		X	X
SD-DR164-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR165-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR166-0000	0 - 10 cm	Channel	X	X	X	X			X		X	X
SD-DR167-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR168-0000	0 - 10 cm	Channel	X	X	X	X	X	X	X	X	X	X
SD-DR169-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR170-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR171-0000	0 - 10 cm	Channel	X	X	X	X			X		X	X
Subsurface Sediment												
SD-DR101-0000A	0 - 2 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR101-0020	2 - 4 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR111-0000A	0 - 2 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR111-0020	2 - 4 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR112-0000A	0 - 2 ft	Intertidal	X	X	X	X			X		X	X
SD-DR112-0020	2 - 4 ft	Intertidal	X	X	X	X			X		X	X
SD-DR123-0000A	0 - 2 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR123-0020	2 - 4 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR139-0000A	0 - 2 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR139-0020	2 - 4 ft	Intertidal	X	X	X	X		X	X		X	X

Table 3-2—Reach B Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
SD-DR139-1000A	0 - 2 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR139-1020	2 - 4 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR142-0000A	0 - 2 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR142-0020	2 - 4 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR154-0000A	0 - 2 ft	Shallow Subtidal	X	X	X	X		X	X		X	X
SD-DR154-0020	2 - 4 ft	Shallow Subtidal	X	X	X	X		X	X		X	X
Sediment Porewater												
PW-DR096-0000	0 - 10 cm ^a	Intertidal	X						X			
PW-DR096-1000	0 - 10 cm ^a	Intertidal	X						X			
PW-DR109-0000	0 - 10 cm ^a	Intertidal	X						X			
PW-DR133-0000	0 - 10 cm ^a	Intertidal	X						X			
PW-DR140-0000	0 - 10 cm ^a	Intertidal	X						X			
PW-DR147-0000	0 - 10 cm ^a	Shallow Subtidal	X						X			
Total No. of Sediment Sample Analyses			101	101	101	101	12	26	41	8	101	101
Total No. of Porewater Sample Analyses			6						6			

^aSediment sampling depth from which porewater will be extracted

Table 3-3—Reach C Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
Surface Sediment												
SD-DR172-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR173-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR174-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR175-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR176-0000	0 - 10 cm	Slip 4	X	X	X	X					X	X
SD-DR177-0000	0 - 10 cm	Slip 4	X	X	X	X					X	X
SD-DR178-0000	0 - 10 cm	Slip 4	X	X	X	X	X	X	X		X	X
SD-DR178-1000	0 - 10 cm	Slip 4	X	X	X	X	X	X	X		X	X
SD-DR179-0000	0 - 10 cm	Slip 4	X	X	X	X					X	X
SD-DR180-0000	0 - 10 cm	Slip 4	X	X	X	X					X	X
SD-DR181-0000	0 - 10 cm	Slip 4	X	X	X	X			X		X	X
SD-DR182-0000	0 - 10 cm	Slip 4	X	X	X	X					X	X
SD-DR183-0000	0 - 10 cm	Slip 4	X	X	X	X	X	X	X	X	X	X
SD-DR184-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR185-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR185-1000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR186-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR187-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X	X	X	X
SD-DR188-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR189-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR190-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X	X	X	X
SD-DR191-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR192-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR193-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR194-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR195-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR196-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR197-0000	0 - 10 cm	Intertidal ^b	X	X	X	X					X	X
SD-DR198-0000	0 - 10 cm	Intertidal ^b	X	X	X	X					X	X
SD-DR199-0000	0 - 10 cm	Intertidal ^b	X	X	X	X			X		X	X
SD-DR200-0000	0 - 10 cm	Intertidal ^b	X	X	X	X					X	X

Table 3-3—Reach C Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
SD-DR201-0000	0 - 10 cm	Intertidal ^b	X	X	X	X					X	X
SD-DR202-0000	0 - 10 cm	Intertidal ^b	X	X	X	X					X	X
SD-DR203-0000	0 - 10 cm	Intertidal ^b	X	X	X	X	X	X	X	X	X	X
SD-DR204-0000	0 - 10 cm	Intertidal ^b	X	X	X	X					X	X
SD-DR205-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR206-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X	X	X	X
SD-DR207-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR208-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR209-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR210-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR211-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR212-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR213-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR214-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR215-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X			X		X	X
SD-DR216-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR217-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X	X	X	X		X	X
SD-DR218-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR219-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR220-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR221-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR222-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR223-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR223-1000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR224-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X	X	X	X	X	X	X
SD-DR225-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR226-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR227-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR228-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X			X		X	X
SD-DR229-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR230-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR231-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR232-0000	0 - 10 cm	Channel	X	X	X	X			X		X	X

Table 3-3—Reach C Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
SD-DR233-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR234-0000	0 - 10 cm	Channel	X	X	X	X			X		X	X
SD-DR235-0000	0 - 10 cm	Channel	X	X	X	X					X	X
Subsurface Sediment												
SD-DR183-0000A	0 - 2 ft	Slip 4	X	X	X	X		X	X		X	X
SD-DR183-0020	2 - 4 ft	Slip 4	X	X	X	X		X	X		X	X
SD-DR187-0000A	0 - 2 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR187-0020	2 - 4 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR206-0000A	0 - 2 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR206-0020	2 - 4 ft	Intertidal	X	X	X	X		X	X		X	X
SD-DR224-0000A	0 - 2 ft	Shallow Subtidal	X	X	X	X		X	X		X	X
SD-DR224-0020	2 - 4 ft	Shallow Subtidal	X	X	X	X		X	X		X	X
Sediment Porewater												
PW-DR181-0000	0 - 10 cm ^a	Slip 4	X						X			
PW-DR228-0000	0 - 10 cm ^a	Shallow Subtidal	X						X			
Total No. of Sediment Sample Analyses			67	67	67	67	12	20	30	6	67	67
Total No. of Porewater Sample Analyses			2						2			

^aSediment sampling depth from which porewater will be extracted

^bSample may be hand-collected in upper intertidal zone at discretion of field coordinator (see Section 3.2.3)

Table 3-4—Reach D Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
Surface Sediment												
SD-DR236-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR237-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR238-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X	X	X	X
SD-DR239-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR240-0000	0 - 10 cm	Slip 6	X	X	X	X					X	X
SD-DR241-0000	0 - 10 cm	Slip 6	X	X	X	X					X	X
SD-DR242-0000	0 - 10 cm	Slip 6	X	X	X	X	X	X	X		X	X
SD-DR242-1000	0 - 10 cm	Slip 6	X	X	X	X	X	X	X		X	X
SD-DR243-0000	0 - 10 cm	Slip 6	X	X	X	X					X	X
SD-DR244-0000	0 - 10 cm	Slip 6	X	X	X	X			X		X	X
SD-DR245-0000	0 - 10 cm	Slip 6	X	X	X	X					X	X
SD-DR246-0000	0 - 10 cm	Slip 6	X	X	X	X			X	X	X	X
SD-DR247-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR248-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR249-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR250-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR251-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR252-0000	0 - 10 cm	Intertidal (TB)	X	X	X	X					X	X
SD-DR253-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR254-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR255-0000	0 - 10 cm	Intertidal ^b	X	X	X	X					X	X
SD-DR256-0000	0 - 10 cm	Intertidal ^b	X	X	X	X	X	X	X	X	X	X
SD-DR257-0000	0 - 10 cm	Intertidal ^b	X	X	X	X					X	X
SD-DR258-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR259-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR260-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR261-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR262-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR263-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR264-0000	0 - 10 cm	Intertidal	X	X	X	X			X	X	X	X
SD-DR265-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X

Table 3-4—Reach D Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
SD-DR265-1000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR266-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR267-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR268-0000	0 - 10 cm	Intertidal (TB)	X	X	X	X					X	X
SD-DR269-0000	0 - 10 cm	Intertidal (TB)	X	X	X	X					X	X
SD-DR270-0000	0 - 10 cm	Intertidal (TB)	X	X	X	X			X		X	X
SD-DR271-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR272-0000	0 - 10 cm	Intertidal	X	X	X	X					X	X
SD-DR273-0000	0 - 10 cm	Intertidal	X	X	X	X			X		X	X
SD-DR274-0000	0 - 10 cm	Intertidal ^b	X	X	X	X					X	X
SD-DR275-0000	0 - 10 cm	Intertidal ^b	X	X	X	X					X	X
SD-DR276-0000	0 - 10 cm	Intertidal ^b	X	X	X	X					X	X
SD-DR277-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR278-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR279-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR280-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR281-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR282-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR283-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR284-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X	X	X	X	X	X	X
SD-DR285-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR286-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR287-0000	0 - 10 cm	Shallow Subtidal	X	X	X	X					X	X
SD-DR288-0000	0 - 10 cm	Channel	X	X	X	X			X		X	X
SD-DR289-0000	0 - 10 cm	Channel	X	X	X	X	X	X	X		X	X
SD-DR290-0000	0 - 10 cm	Channel	X	X	X	X					X	X
SD-DR291-0000	0 - 10 cm	TB	X	X	X	X	X	X	X	X	X	X
SD-DR292-0000	0 - 10 cm	TB	X	X	X	X					X	X
SD-DR292-1000	0 - 10 cm	TB	X	X	X	X					X	X
SD-DR293-0000	0 - 10 cm	Upchannel of TB	X	X	X	X					X	X
SD-DR294-0000	0 - 10 cm	Upchannel of TB	X	X	X	X					X	X
SD-DR295-0000	0 - 10 cm	Upchannel of TB ^b	X	X	X	X					X	X
SD-DR296-0000	0 - 10 cm	Upchannel of TB ^b	X	X	X	X					X	X

Table 3-4—Reach D Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	vOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
Subsurface Sediment												
SD-DR246-0000A	0 - 2 ft	Slip 6	X	X	X	X			X		X	X
SD-DR246-0020	2 - 4 ft	Slip 6	X	X	X	X			X		X	X
SD-DR284-0000A	0 - 2 ft	Shallow Subtidal	X	X	X	X		X	X		X	X
SD-DR284-0020	2 - 4 ft	Shallow Subtidal	X	X	X	X		X	X		X	X
SD-DR291-0000A	0 - 2 ft	TB	X	X	X	X		X	X		X	X
SD-DR291-0020	2 - 4 ft	TB	X	X	X	X		X	X		X	X
Sediment Porewater												
PW-DR244-0000	0 - 10 cm ^a	Slip 6	X						X			
PW-DR260-0000	0 - 10 cm ^a	Intertidal	X						X			
PW-DR262-0000	0 - 10 cm ^a	Intertidal	X						X			
Total No. of Sediment Sample Analyses			71	71	71	71	10	14	26	6	71	71
Total No. of Porewater Sample Analyses			3						3			

^aSediment sampling depth from which porewater will be extracted

^bStation located upchannel of Boeing Developmental Center pedestrian bridge, therefore, will be sampled via small, shallow-draft vessel

TB = Turning Basin

Table 3-5—Background Sampling Locations and Analyses

Sample Number	Sample Depth (below mudline)	Location	Analysis									
			TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	Dioxins	TOC	Grain Size
Surface Sediment												
SD-DR297-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR298-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X	X	X	X
SD-DR299-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR300-0000	0 - 10 cm	Intertidal	X	X	X	X	X	X	X		X	X
SD-DR301-0000	0 - 10 cm	Midchannel	X	X	X	X	X	X	X	X	X	X
Sediment Porewater												
PW-DR298-0000	0 - 10 cm ^a	Intertidal	X						X			
PW-DR301-0000	0 - 10 cm ^a	Midchannel	X						X			
Total No. of Sediment Sample Analyses			5	5	5	5	5	5	5	2	5	5
Total No. of Porewater Sample Analyses			2						2			

^aSediment sampling depth from which porewater will be extracted

Table 4-1—Sample Containers, Preservation, and Holding Times

Analysis	Matrix	Containers ^a		Preservation	Holding Time ^b
		Field	Lab		
TAL Metals	Sediment	1 - 4 oz glass	1 - 4 oz glass	None	6 months (28 days Hg)
	Porewater ^c	2 - 2 gallon HDPE buckets (sediment)	1 - 1 L polyethylene (extracted porewater)	HNO ₃ to pH < 2 (lab)	
BNAs/PCB Aroclors and Congeners	Sediment	1 - 8 oz glass	1 - 8 oz glass	Cool to 4° C	Extraction = 7 days Analysis = 40 days
VOCs	Sediment	2 - 120 mL VOA jars	2 - 120 mL VOA jars	Cool to 4° C	Analysis = 7 days
Pesticides	Sediment	1 - 8 oz glass	1 - 8 oz glass	Cool to 4° C	Extraction = 7 days Analysis = 40 days
Organotins	Sediment	1 - 8 oz glass	1 - 8 oz glass	Cool to 4° C	14 days
	Porewater ^c	2 - 2 gallon HDPE buckets (sediment)	1 - 1 L polycarbonate (extracted porewater)	HCl to pH < 2 Cool to 4° C	7 days
Dioxins/Furans	Sediment	1 - 4 oz glass	1 - 4 oz glass	Cool to 4° C	6 months
Total Organic Carbon	Sediment	1 - 4 oz glass	1 - 4 oz glass	Cool to 4° C	14 days
Grain Size	Sediment	1 - 16 oz glass	1 - 16 oz glass	Cool to 4° C	6 months

^aAll glass containers will be wide-mouth

^bHolding times are from date of sample collection

^cPorewater will be extracted and preserved at the analytical laboratory

Table 5-1—QA/QC Sample Types and Analyses

Sample Number	TAL Metals	BNAs	PCB Aroclors	PCB Congeners	VOCs	Pesticides	Organotins	TOC	Grain Size	Purpose
Surface Sediment										
SD-DR004-1000	X	X	X	X				X	X	Surface sediment field duplicate
SD-DR022-1000	X	X	X	X				X	X	Surface sediment field duplicate
SD-DR045-1000	X	X	X	X				X	X	Surface sediment field duplicate
SD-DR053-1000	X	X	X	X	X	X	X	X	X	Surface sediment field duplicate
SD-DR069-1000	X	X	X	X				X	X	Surface sediment field duplicate
SD-DR092-1000	X	X	X	X	X	X	X	X	X	Surface sediment field duplicate
SD-DR113-1000	X	X	X	X				X	X	Surface sediment field duplicate
SD-DR131-1000	X	X	X	X				X	X	Surface sediment field duplicate
SD-DR141-1000	X	X	X	X				X	X	Surface sediment field duplicate
SD-DR178-1000	X	X	X	X	X	X	X	X	X	Surface sediment field duplicate
SD-DR185-1000	X	X	X	X	X	X	X	X	X	Surface sediment field duplicate
SD-DR223-1000	X	X	X	X				X	X	Surface sediment field duplicate
SD-DR242-1000	X	X	X	X	X	X	X	X	X	Surface sediment field duplicate
SD-DR265-1000	X	X	X	X				X	X	Surface sediment field duplicate
SD-DR292-1000	X	X	X	X				X	X	Surface sediment field duplicate
Subsurface Sediment										
SD-DR139-1000A	X	X	X	X		X	X	X	X	Subsurface sediment field duplicate
SD-DR139-1020	X	X	X	X		X	X	X	X	Subsurface sediment field duplicate
Sediment Porewater										
PW-DR096-1000	X						X			Porewater field duplicate

Table 5-2--Analytical Methods, Parameters, and Quantitation Limits for Sediment Samples

Analyte	QL Goals	Reference Method
Inorganics (mg/kg dry weight)		
Aluminum	40	6010
Antimony	5	6010
Arsenic	5	6010/7060A
Barium	40	6010
Beryllium	1	6010
Cadmium	0.3	6010
Calcium	1000	6010
Chromium	5	6010
Cobalt	10	6010
Copper	5	6010
Iron	20	6010
Lead	2	6010
Magnesium	1000	6010
Manganese	5	6010
Mercury	0.05	7471A
Nickel	1	6010
Potassium	1000	6010
Selenium	15	6010/7740
Silver	1	6010/7761
Sodium	1000	6010
Thallium	5	6010/7841
Vanadium	10	6010
Zinc	5	6010
BNAs (µg/kg dry weight)		
1,2,4-Trichlorobenzene	20	8270 - PSEP
1,2-Dichlorobenzene	20	8270 - PSEP
1,3-Dichlorobenzene	20	8270 - PSEP
1,4-Dichlorobenzene	20	8270 - PSEP
2,2'-Oxybis(1-chloropropane)	40	8270 - PSEP
2,4,5-Trichlorophenol	200	8270 - PSEP
2,4,6-Trichlorophenol	200	8270 - PSEP
2,4-Dichlorophenol	60	8270 - PSEP
2,4-Dimethylphenol	20	8270 - PSEP
2,4-Dinitrophenol	200	8270 - PSEP
2,4-Dinitrotoluene	200	8270 - PSEP
2,6-Dinitrotoluene	200	8270 - PSEP
2-Chloronaphthalene	20	8270 - PSEP
2-Chlorophenol	20	8270 - PSEP
2-Methylnaphthalene	20	8270 - PSEP
2-Methylphenol	20	8270 - PSEP
2-Nitroaniline	100	8270 - PSEP
2-Nitrophenol	100	8270 - PSEP
3,3'-Dichlorobenzidine	200	8270 - PSEP
3-Nitroaniline	200	8270 - PSEP
4,6-Dinitro-2-methylphenol	200	8270 - PSEP
4-Bromophenyl-phenylether	40	8270 - PSEP
4-Chloro-3-methylphenol	40	8270 - PSEP
4-Chloroaniline	60	8270 - PSEP
4-Chlorophenyl-phenylether	20	8270 - PSEP
4-Methylphenol	20	8270 - PSEP
4-Nitroaniline	100	8270 - PSEP
4-Nitrophenol	100	8270 - PSEP

Table 5-2--Analytical Methods, Parameters, and Quantitation Limits for Sediment Samples

Analyte	QL Goals	Reference Method
Acenaphthene	20	8270 - PSEP
Acenaphthylene	20	8270 - PSEP
Anthracene	20	8270 - PSEP
Benzo(a)anthracene	20	8270 - PSEP
Benzo(a)pyrene	20	8270 - PSEP
Benzo(b)fluoranthene	20	8270 - PSEP
Benzo(g,h,i)perylene	20	8270 - PSEP
Benzo(k)fluoranthene	20	8270 - PSEP
Benzoic acid	200	8270 - PSEP
Benzyl alcohol	50	8270 - PSEP
bis(2-Chloroethoxy)methane	40	8270 - PSEP
bis(2-Chloroethyl)ether	40	8270 - PSEP
bis(2-Ethylhexyl)phthalate	20	8270 - PSEP
Butylbenzylphthalate	20	8270 - PSEP
Carbazole	20	8270 - PSEP
Chrysene	20	8270 - PSEP
Di-n-butylphthalate	20	8270 - PSEP
Di-n-octylphthalate	20	8270 - PSEP
Dibenz(a,h)anthracene	20	8270 - PSEP
Dibenzofuran	20	8270 - PSEP
Diethylphthalate	20	8270 - PSEP
Dimethylphthalate	20	8270 - PSEP
Fluoranthene	20	8270 - PSEP
Fluorene	20	8270 - PSEP
Hexachlorobenzene	20	8270 - PSEP
Hexachlorobutadiene	20	8270 - PSEP
Hexachlorocyclopentadiene	100	8270 - PSEP
Hexachloroethane	20	8270 - PSEP
Indeno(1,2,3-cd)pyrene	20	8270 - PSEP
Isophorone	20	8270 - PSEP
N-nitroso-di-n-propylamine	40	8270 - PSEP
N-nitrosodiphenylamine	40	8270 - PSEP
Naphthalene	20	8270 - PSEP
Nitrobenzene	20	8270 - PSEP
Pentachlorophenol	100	8270 - PSEP
Phenathrene	20	8270 - PSEP
Phenol	20	8270 - PSEP
Pyrene	20	8270 - PSEP
PCB Congeners (µg/kg dry weight)		
2,2',5'-Trichlorobiphenyl	1	8082
2,4',4'-Trichlorobiphenyl	1	8082
2,2'3 5'-Tetrachlorobipheny	1	8082
2,2'5 5'-Tetrachlorobipheny	1	8082
2,3'4 4'-Tetrachlorobipheny	1	8082
3,3'4 4'-Tetrachlorobipheny	1	8082
3,3',5,5'-Tetrachlorobiphenyl	1	8082
2,2',4,5,5'-Pentachlorobiphenyl	1	8082
2,3,3',4,4'-Pentachlorobiphenyl	1	8082
2,3,4,4',5-Pentachlorobiphenyl	1	8082
2,3',4,4',5-Pentachlorobiphenyl	1	8082
3,3',4,4',5-Pentachlorobiphenyl	1	8082
2,2',3,3',4,4'-Hexachlorobiphenyl	1	8082
2,2',3,4,4',5'-Hexachlorobiphenyl	1	8082

Table 5-2--Analytical Methods, Parameters, and Quantitation Limits for Sediment Samples

Analyte	QL Goals	Reference Method
2,2',4,4',5,5'-Hexachlorobiphenyl	1	8082
2,3,3',4,4',5'-Hexachlorobiphenyl	1	8082
2,3,3',4,4',5-Hexachlorobiphenyl	1	8082
2,3',4,4',5,5'-Hexachlorobiphenyl	1	8082
3,3',4,4',5,5'-Hexachlorobiphenyl	1	8082
2,2',3,3',4,4',5-Heptachlorobiphenyl	1	8082
2,2',3,4,4',5,5'-Heptachlorobiphenyl	1	8082
2,2',3,4',5,5',6-Heptachlorobiphenyl	1	8082
2,3,3',4',4',5,5'-Heptachlorobiphenyl	1	8082
2,2',3,3',4,4',5,6-Octachlorobiphenyl	1	8082
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl	1	8082
Decachlorobiphenyl	1	8082
PCB Aroclors (µg/kg dry weight)		
Aroclor 1016	20	8082 - PSEP
Aroclor 1221	40	8082 - PSEP
Aroclor 1232	20	8082 - PSEP
Aroclor 1242	20	8082 - PSEP
Aroclor 1248	20	8082 - PSEP
Aroclor 1254	20	8082 - PSEP
Aroclor 1260	20	8082 - PSEP
Pesticides (µg/kg dry weight)		
Aldrin	1	8081 - PSEP
α-BHC	1	8081 - PSEP
β-BHC	1	8081 - PSEP
γ-BHC (Lindane)	1	8081 - PSEP
α-Chlordane	1	8081 - PSEP
γ-Chlordane	1	8081 - PSEP
Dieldrin	2	8081 - PSEP
Endrin	2	8081 - PSEP
Endosulfan	1	8081 - PSEP
Endosulfan II	2	8081 - PSEP
Endosulfan sulfate	2	8081 - PSEP
Methoxychlor	1	8081 - PSEP
Endrin ketone	2	8081 - PSEP
Endrin aldehyde	2	8081 - PSEP
Toxaphene	10	8081 - PSEP
Heptachlor	1	8081 - PSEP
Heptachlor epoxide	1	8081 - PSEP
4,4'-DDT	2	8081 - PSEP
4,4'-DDD	2	8081 - PSEP
4,4'-DDE	2	8081 - PSEP
VOCs (µg/kg dry weight)		
Chloromethane	10	8260 - CLP
Bromomethane	10	8260 - CLP
Vinyl chloride	10	8260 - CLP
Chloroethane	10	8260 - CLP
Methylene chloride	10	8260 - CLP
Acetone	10	8260 - CLP
Carbon disulfide	10	8260 - CLP
1,1-Dichloroethene	10	8260 - CLP
1,1-Dichloroethane	10	8260 - CLP
1,2-Dichloroethene (total, cis- + trans-)	10	8260 - CLP
Chloroform	10	8260 - CLP

Table 5-2--Analytical Methods, Parameters, and Quantitation Limits for Sediment Samples

Analyte	QL Goals	Reference Method
1,2-Dichloroethane	10	8260 - CLP
2-Butanone (MEK)	10	8260 - CLP
1,1,1-Trichloroethane	10	8260 - CLP
Carbon tetrachloride	10	8260 - CLP
Bromodichloromethane	10	8260 - CLP
1,2-Dichloropropane	10	8260 - CLP
cis-1,3-Dichloropropene	10	8260 - CLP
Trichloroethene	10	8260 - CLP
Dibromochloromethane	10	8260 - CLP
1,1,2-Trichloroethane	10	8260 - CLP
Benzene	10	8260 - CLP
trans-1,3-Dichloropropene	10	8260 - CLP
Bromoform	10	8260 - CLP
4-Methyl-2-Pentanone (MIBK)	10	8260 - CLP
2-Hexanone (MBK)	10	8260 - CLP
Tetrachloroethene	10	8260 - CLP
Toluene	10	8260 - CLP
1,1,2,2-Tetrachlorethane	10	8260 - CLP
Chlorobenzene	10	8260 - CLP
Ethyl Benzene	10	8260 - CLP
Styrene	10	8260 - CLP
Xylenes (total, o-, m-, p-)	10	8260 - CLP
Ethylbenzene	10	8260 - CLP
Tetrachloroethene	10	8260 - CLP
Trichloroethene	10	8260 - CLP
Total Xylene	10	8260 - CLP
Organotins (µg/kg dry weight)		
Monobutyltin	10	PSEP
Dibutyltin	10	PSEP
Tributyltin ^c	5	PSEP
Tetrabutyltin	10	PSEP
Dioxin/Furan (ng/kg dry weight)		
See Appendix A	2 - 50 (Congener-specific)	EPA 8290
Physical and Conventional Parameters		
Grain size	0.01%	ASTM D-442-63/PSEP
Total Organic Carbon	200 mg/kg	9060-PSEP mod

QL - Quantitation Limit

Table 5-3—Analytical Methods, Parameters, and Quantitation Limits for Porewater Samples

Analyte	QL Goals	Reference Method	Federal Marine AWQC		State Marine AWQC	
			Acute	Chronic	Acute	Chronic
Inorganics (µg/L)						
Aluminum	200	6010 / CLP	--	--	--	--
Antimony	60	6010 / CLP	1500 ^b	500 ^b	--	--
Arsenic	10	6010 / CLP	69	36	69 ^c	36 ^c
Barium	200	6010 / CLP	--	--	--	--
Beryllium	5	6010 / CLP	--	--	--	--
Cadmium	5	6010 / CLP	43	9.3	42 ^c	9.3 ^c
Calcium	5000	6010 / CLP	--	--	--	--
Chromium	10	6010 / CLP	1100	50	1100 ^c	50 ^c
Cobalt	50	6010 / CLP	--	--	--	--
Copper	2	6010	2.9	--	48 ^c	3.1 ^c
Iron	100	6010 / CLP	--	--	--	--
Lead	3	6010 / CLP	220	8.5	210 ^c	8.1 ^c
Magnesium	5000	6010 / CLP	--	--	--	--
Manganese	15	6010 / CLP	--	--	--	--
Mercury	0.1 ^d	7471A	2.1	0.025	1.8 ^c	0.025
Nickel	10 ^d	6010	75	8.3	74 ^c	8.2 ^c
Potassium	5000	6010 / CLP	--	--	--	--
Selenium	5	6010 / CLP	300	71	290 ^c	71 ^c
Silver	0.2	7761	7.2 ^b	0.92 ^b	1.9 ^c	--
Sodium	5000	6010 / CLP	--	--	--	--
Tin	10	6010	--	--	--	--
Thallium	40	6010 / CLP	2130 ^a	--	--	--
Vanadium	50	6010 / CLP	--	--	--	--
Zinc	20	6010 / CLP	95	86	90 ^c	81 ^c
Organotins (µg/L)						
Monobutyltin	0.10	PSEP	--	--	--	--
Dibutyltin	0.05	PSEP	--	--	--	--
Tributyltin	0.020	PSEP	0.15 ^e	0.37 ^b	--	--
Tetrabutyltin	0.05	PSEP	--	--	--	--

^aInsufficient data to develop criterion, value presented is the Lowest Observed Effect Level (LOEL)

^bProposed criterion

^cCriterion based on dissolved fraction

^dDetection limit exceeds one or more screening criteria

^e1998 Dredge Material Management Program (DMMP) Screening Level (SL)

QL = Quantitation Limit

AWQC= Ambient Water Quality Criteria

-- = Not available

APPENDIX A
QAPP AMENDMENTS

APPENDIX A
QAPP AMENDMENTS

POLYCHLORINATED DIOXINS/FURANS

Samples will be analyzed using high resolution capillary column gas chromatography/high-resolution mass spectrometry (HRGC/HRMS) analyses for dioxins and furans, 2,3,7,8-tetrachlorodibenzo-p-dioxin, 2,3,7,8-tetrachlorodibenzo-p-furan, tetra- through octa-polychlorinated dibenzodioxin homologues, and tetra- through octa- polychlorinated dibenzofuran homologues in sediment samples using SW846 Method 8290.

Percent moisture determinations are required for all sediment samples for reporting results on a dry weight basis.

Sample extraction and analysis must be performed within 14 days of receipt of samples. The complete data package is required 28 days from receipt of each batch of samples. A batch is defined as a maximum of 20 samples received by the laboratory within a two week period.

Target analytes and quantitation limit goals are presented below:

Analyte	Quantitation Limit Goal (ng/kg)	Reference Method
2,3,7,8-TCDF	2	8290
Total TCDF	2	8290
2,3,7,8-TCDD	2	8290
Total TCDD	2	8290
1,2,3,7,8-PeCDF	10	8290
2,3,4,7,8-PeCDF	10	8290
Total PeCDF	10	8290
1,2,3,7,8-PeCDD	10	8290
Total PeCDD	10	8290
1,2,3,4,7,8-HxCDF	20	8290
1,2,3,6,7,8-HxCDF	20	8290
1,2,3,7,8,9-HxCDF	20	8290
2,3,4,6,7,8-HxCDF	20	8290
Total HxCDF	20	8290

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Analyte	Quantitation Limit Goal (ng/kg)	Reference Method
1,2,3,4,7,8-HxCDD	20	8290
1,2,3,6,7,8-HxCDD	20	8290
1,2,3,7,8,9-HxCDD	20	8290
Total HxCDD	20	8290
1,2,3,4,6,7,8-HpCDF	30	8290
1,2,3,4,7,8,9-HpCDF	30	8290
Total HpCDF	30	8290
1,2,3,4,6,7,8-HpCDD	40	8290
Total HpCDD	40	8290
OCDF	50	8290
OCDD	50	8290

The following shall be included for each Sample Delivery Group (not to exceed 20 samples):

- Signed chain-of-custody forms
- Laboratory sample log-in forms
- Any telephone logs or copies of faxes referring to the samples
- A case narrative signed by the laboratory manager or his/her designee certifying that analysis was performed according to the specified methods (with modifications herein) and certifying the accuracy and validity of all data reported. All problems encountered (including exceedances of QC criteria) in the analysis and their resolution must be described.
- All pages in the data deliverable shall be numbered and legible.
- Tabulated sample results with laboratory and WESTON sample number, date and time of sample receipt, extraction, and analysis, units, percent solids, dilution factor, and sample weights or volumes clearly specified.
- Blank data with tabulated results. Indicate which samples are associated with each blank.
- Matrix spike/MS Duplicate result summaries with calculated percent recovery and relative percent difference values.

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- Laboratory duplicate sample result summary with calculated relative percent difference values.
- Laboratory control sample (LCS) result summary with concentrations and calculated relative percent difference values.
- Continuing Calibration Verification (CCV) result summary with concentrations and calculated relative percent difference values.
- Detailed explanation of the quantitation and identification procedure used for each of the homologous series and for isomer specific analysis.
- Example calculations of response ratios (RRFs), sample results and detection limits.
- (5.) List of exact ion masses, response factors and retention times used for each isomer/class.
- Simultaneous offset display of single ion chromatograms (EICPs) for the analyte peaks to check for the polychlorinated diphenyl ethers which may co-elute.
- Tabulated recoveries of Internal Standards and Surrogates compared to the concentration used.
- Standard curve RFs, RRFs and %RSDs for initial and continuing calibrations.
- EICPs of performance check mixtures showing first and last eluting compounds of each homologous series as well as the percent valley resolution required for 2,3,7,8-TCDD (see page D-28 of Method 8290).
- Complete documentation of initial and continuing calibrations and samples to include the tabulated results of ion ratios and offset simultaneous displays of the single ion chromatograms of the two most abundant ions in the molecular ion region.
- A copy of bench sheets for sample preparation indicating dates, times, method of sample preparation, standard information, spike volumes/amounts added, instrument run time/date, etc. All bench sheets and logs shall have the analyst's signature.
- Further, if an analyte is not detected in the sample, the sample detection limit must be reported.
- The laboratory shall also respond within seven days to written requests for missing data or with additional information or explanations that result from data inspection, validation, or review activities by WESTON.

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Quality control criteria are summarized below:

Quality Control	Frequency	Sediment Criteria
Method Blank	1 per batch of 20 or fewer samples for each matrix	Conc < Reporting limit
MS/MSD	1 per batch of 20 or fewer samples for each matrix	Recovery - see below RPD < 35 %
Recovery Standards ¹³ C ₁₂ -1,2,3,4-TCDD ¹³ C ₁₂ -1,2,3,7,8,9-HxCDD	Added to every sample	Recovery = 60 - 140%

ORGANOTIN ANALYSIS

Marine sediment and extracted porewater samples will be analyzed for butyltin species in accordance with method summarized in the Puget Sound Estuary Program (PSEP) Protocols and described in detail by Krone et al. (1989) and Muller (1987). Samples are extracted with a tropolone/methylene chloride mixture and derivatized with a Grignard reagent to form the pentyl or hexyl derivatives. The components are separated by gas chromatography and detected with a flame photometric detector. Alternatively, mass spectral or atomic emission detection may be used if required sensitivity can be achieved. Detection limits will be 10 - 20 ng/L for water and 10 µg/kg for sediment (dry weight basis).

Percent moisture determinations are required for all sediment samples according to the EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for reporting results on a dry weight basis.

Sample extraction must be performed within 7 days of sample collection. Sample extracts shall be analyzed within 7 days of extraction. A batch is defined as a maximum of 20 samples received by the laboratory within a two week period.

All equipment that may be in contact with sediment must be stainless steel, polycarbonate plastic, high density polyethylene (HDPE), Teflon™, or glass. Cap liners shall be Teflon™. After normal cleaning procedures, all laboratory equipment and glassware used for porewater extraction and subsequent TBT analysis shall be additionally rinsed according to the following sequence using residue analysis grade solvents:

1. acetone (not to be used on polycarbonate equipment)
2. 0.1% tropolone/hexane
3. hexane

Porewater extraction will be performed by centrifugation. Standing water, if any, will be reincorporated into sediment prior to centrifuging. Sediment must be loaded into centrifuge tubes and spun under an inert atmosphere (i.e., nitrogen flushed).

Samples will be centrifuged in polycarbonate tubes to settle all particles greater than approximately one micron in diameter (a minimum of 30 minutes at 3,000 g). It is assumed that porewater recovery will be approximately 25 percent of the sediment volume depending upon grain size. Sample temperature during porewater extraction must not exceed 10°C. Porewater must be carefully decanted to prevent entrainment of particulate matter and centrifuged a second time (30 minutes at 3,000-9,000 g) to remove residual particles. Extracted porewater will be preserved with HCl to pH less than 2 and stored in precleaned polycarbonate bottles with Teflon-lined lids at 4°C until derivitization and analysis. Porewater must be analyzed within 7 days of extraction.

The following method modifications are required:

- When method blank results exceed target detection limits, all associated samples and blanks must be re-extracted and reanalyzed unless sample concentrations are greater than five times the associated blank concentration.
- Since commercially available Grignard reagents often contain tin contamination, the laboratory must demonstrate that reagents are free of interfering concentrations of tin or, preferably, the organomagnesium derivitization reagent must be prepared by the laboratory using high purity (e.g., semiconductor grade) magnesium. In addition, a large excess of Grignard reagent should be avoided during the derivitization reaction to reduce potential laboratory contamination. Another potential source of tin contamination that should be avoided is polyvinylchloride plastics.

Analytes and detection limit requirements are presented below:

Analyte	Sediment Detection Limit (µg/kg - dry weight)	Porewater Detection Limit (µg/L)
Monobutyltin	10	0.10
Dibutyltin	10	0.05
Tributyltin	5	0.020
Tetrabutyltin	10	0.05

The following shall be included for each Sample Delivery Group (not to exceed 20 samples):

- Signed chain-of-custody forms.

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- Laboratory sample log-in forms.
- Any telephone logs or copies of faxes referring to the samples.
- A case narrative signed by the laboratory manager or his/her designee certifying that analysis was performed according to the specified methods (with modifications herein) and certifying the accuracy and validity of all data reported. All problems encountered (including exceedances of QC criteria) in the analysis and their resolution must be described.
- Tabulated sample results with laboratory and WESTON sample number, date and time of sample receipt, extraction, and analysis, units, percent solids, dilution factor, and sample weights or volumes, and surrogate compound recoveries and control limits clearly specified.
- Blank data with tabulated results. Indicate which samples are associated with each blank.
- Surrogate compound recovery summary for all samples with control limits specified
- Matrix Spike/MS Duplicate result summaries with calculated percent recovery and relative percent difference values and control limits.
- Laboratory control sample (LCS) result summary with concentrations and calculated relative percent difference values.
- Continuing Calibration Verification (CCV) result summary with concentrations, response factors, and calculated relative percent difference values.
- All sample and blank results, computer printouts, calibration curves, calibration factors and QC results. All computer printouts will be labeled with the sample number and date/ time of analysis at a minimum. Calibration factors (and RSD where applicable) will be reported for all standards analyzed.
- Bench sheets for sample preparation indicating dates, times, method of sample preparation, standard information, spike volumes/amounts added, instrument run time/date, etc. All bench sheets and logs shall have the analyst's signature.
- A formula (including definitions) showing how the results were calculated, with an example of an actual calculation.

Further requirements include

- All pages in the data deliverable shall be numbered and legible.
- The laboratory shall respond within seven days to written requests for missing data or with additional information or explanations that result from data inspection/validation/review activities by WESTON.

Quality control requirements are summarized below:

Quality Control	Frequency	Porewater Criteria	Sediment Criteria
Quantitation Limit		See Section 8	See Section 8
Method Blank	1 per batch of 20 or fewer samples for each matrix	Conc < Reporting limit	Conc < Reporting limit
MS/MSD	1 per batch of 20 or fewer samples for each matrix	TBT - 40 - 120% DBT - 30 - 120% MBT - 10 - 120%	TBT - 40 - 120% DBT - 30 - 120% MBT - 10 - 120%
Calibration	Minimum 4-point mixed calibration standards immediately prior to each analytical batch	% RSD < 25 %	% RSD < 25 %
Calibration Check	Mid-level standard after every 10 samples	% Difference < 25%	% Difference < 25%
Surrogate compound	Triphenyl in all samples and blanks	Recovery 60 - 120%	Recovery 60 - 120%
Laboratory Control Sample (blank spike)	1 per batch of 20 or fewer samples for each matrix Porewater LCS must be centrifuged and filtered prior to derivitization and analysis	Recovery 60 - 130%	Recovery 60 - 130%
Duplicate Analysis	1 per batch of 20 or fewer samples for each matrix	% RSD < 25 %	% RSD < 35 %

POLYCHLORINATED BIPHENYLS CONGENER ANALYSIS

Marine sediment samples will be analyzed for EPA Target Compound List (TCL) polychlorinated biphenyls (PCBs) in accordance with the Puget Sound Estuary Program (PSEP)

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protocol modifications to EPA Method 8082. Sediment samples will be extracted by either SW-846 Method 3550B, ultrasonic extraction, or Method 3540C, sohxlet extraction.

Percent moisture determinations are required for all samples according to the EPA Contract Laboratory Program (CLP) Statement of Work (SOW) OLM03.1. for reporting results on a dry-weight basis.

Sample extraction must be performed within 7 days of sample collection for marine sediment. Sample extracts shall be analyzed within 40 days of extraction. Notwithstanding the sample holding times, the complete data package is required 14 days from receipt of each batch of samples. A batch is defined as a maximum of 20 samples received by the laboratory within a two week period.

The following analytical modifications to Method 8082 are required:

- When method blank results exceed target detection limits, all associated samples and blanks must be extracted and analyzed again, unless sample concentrations are greater than five times and associated blank concentration.
- A 50 to 150 gram sample shall be extracted, as required to achieve detection limits
- Final sample extracts shall be concentrated to 0.5 mL, as required to achieve detection limits.
- Gel permeation chromatography, cleanup, and/or florisil cleanup of sample extracts may be required, based on the analysts professional judgement.
- Sulfuric acid cleanup of all sample extracts is required.
- Sulfur cleanup of all sample extracts is required if sulfur interferences are present. Sulfur interferences are anticipated since samples will be collected from anoxic marine sediment.
- Second column GC confirmation is required on a dissimilar column for all samples where one or more of the target analytes are detected at concentrations above the quantitation limit goal. All calibration and method specified performance criteria must be met for both GC columns. The lower of the two concentrations shall be reported.

Analytes and detection limit requirements are presented below:

Analyte	BZ #	QL Goals
PCB Congener (µg/kg dry weight)		
2,2',5-trichlorobiphenyl	18	1
2,4,4' - trichlorobiphenyl	28	1
2,2',3,5' - tetrachlorobiphenyl	44	1
2,2',5,5' - tetrachlorobiphenyl	52	1
2,3',4,4' - tetrachlorobiphenyl	66	1
3,3',4,4' - tetrachlorobiphenyl	77	1
3,3',5,5' - tetrachlorobiphenyl	81	1
2,2',4,5,5' - pentachlorobiphenyl	101	1
2,3,3',4,4' - pentachlorobiphenyl	105	1
2,3,4,4',5 - pentachlorobiphenyl	114	1
2,3',4,4',5 - pentachlorobiphenyl	118	1
2,3,4,4',5 - pentachlorobiphenyl	123	1
3,3',4,4',5 - pentachlorobiphenyl	126	1
2,2',3,3',4,4' - hexachlorobiphenyl	128	1
2,2',3,4,4',5' - hexachlorobiphenyl	138	1
2,2',4,4',5,5' - hexachlorobiphenyl	153	1
2,3,3',4,4',5 - hexachlorobiphenyl	156	1
2,3,3',4,4',5' - hexachlorobiphenyl	157	1
2,3',4,4',5,5' - hexachlorobiphenyl	167	1
3,3',4,4',5,5' - hexachlorobiphenyl	169	1
2,2',3,3',4,4',5 - heptachlorobiphenyl	170	1
2,2',3,4,4',5,5' - heptachlorobiphenyl	180	1
2,2',3,4',5,5',6 - heptachlorobiphenyl	187	1
2,3,3',4,4',5,5' - heptachlorobiphenyl	189	1
2,2',3,3',4,4',5,6 - octachlorobiphenyl	195	1
2,2',3,3',4,4',5,5',6 - nonachlorobiphenyl	206	1
decachlorobiphenyl	209	1

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Data deliverables shall follow the format of the EPA CLP deliverable requirements for hardcopy results. The following shall be included for each Sample Delivery Group (not to exceed 20 samples):

- Signed chain-of-custody forms.
- Laboratory sample log-in forms.
- Any telephone logs or copies of faxes referring to the samples.
- A case narrative signed by the laboratory manager or his/her designee certifying that analysis was performed according to the specified methods (with modifications herein) and certifying the accuracy and validity of all data reported. All problems encountered (including exceedances of QC criteria) in the analysis and their resolution must be described.
- Tabulated sample results with laboratory and WESTON sample number, date and time of sample receipt, extraction, and analysis, units, percent solids, dilution factor, and sample weights or volumes, and surrogate compound recoveries and control limits clearly specified.
- Blank data with tabulated results. Indicate which samples are associated with each blank.
- Surrogate compound recovery summary for all samples with control limits specified
- Matrix Spike/MS Duplicate result summaries with calculated percent recovery and relative percent difference values and control limits.
- Laboratory duplicate sample result summary with calculated relative percent difference values.
- Laboratory control sample (LCS) result summary with concentrations and calculated relative percent difference values.
- Continuing Calibration Verification (CCV) result summary with concentrations, response factors, and calculated relative percent difference values.
- All sample and blank results, computer printouts, calibration curves, calibration factors and QC results. All computer printouts will be labeled with the sample number, and date/ time of analysis at a minimum. Calibration factors (and RSD where applicable) will be reported for all standards analyzed.

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- A copy of bench sheets for sample preparation indicating dates, times, method of sample preparation, standard information, spike volumes/amounts added, instrument run time/date, etc. All bench sheets and logs shall have the analyst's signature.
- A formula (including definitions) showing how the results were calculated, with an example of an actual calculation.

Further requirements included:

- All pages in the data deliverable shall be numbered and legible.
- The laboratory shall respond within seven days to written requests for missing data or with additional information or explanations that result from data inspection/validation/review activities by WESTON.

Quality control requirements are summarized below:

Quality Control	Frequency	Soil Criteria
Quantitation Limit		See above table
Method Blank	1 per batch of 20 or fewer samples for each matrix	Conc < Reporting limit
MS/MSD	1 per batch of 20 or fewer samples for each matrix	per CLP SOW
Calibration	per CLP SOW	per CLP SOW
Calibration Check	per CLP SOW	per CLP SOW
Laboratory Control Sample	1 per batch of 20 or fewer samples for each matrix	Recovery 70 - 130%
Duplicate Analysis	1 per batch of 20 or fewer samples for each matrix	% RSD < 35 %

REFERENCES

Krone, C.A., D.W. Brown, D.G. Burrows, R.G. Bogar, S.L. Chan, and U. Varanasi. 1989. A Method for Analysis of Butyltin Species and the Measurement of Butyltins in Sediment and English Sole Livers from Puget Sound. *Mar. Environ. Res.* 27:1-18.

Muller, M.D. 1987. Comprehensive Trace Level Determination of Organotin Compounds in Environmental Samples Using High Resolution Gas Chromatography with Flame Photometric Detection. *Anal. Chem.* 59:541-544.

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APPENDIX B

SEDIMENT FIELD SAMPLE RECORD FORMS



SURFACE SEDIMENT FIELD SAMPLE RECORD

Project Name: _____ Project Location: _____ Project No.: _____ Date: _____	Sampling Personnel: _____ Sampling Vessel: _____ Subcontractor(s): _____ Weather: _____
WESTON Sample No.: _____ EPA Sample No.: _____ Analyses: _____	Sampling Method: _____ Proposed Location: _____

Grab #	Time	Depth to Sed. (ft/m)	Coordinates		Grab Accpt. ?	Penet. Depth (cm)	Color	Texture	Odor	Debris	Other
			X	Y							

Color Codes

BR = Brown
 BK = Black
 GY = Gray
 GR = Green
 RST = Rust

Texture Codes

SC = Silt/Clay
 SD = Sand
 GR = Granule
 PB = Pebble
 GV = Gravel

Odor Codes

H₂S = Sulfide
 TPH = Petroleum

SL = Slight
 M = Moderate
 ST = Strong

Other:

Include presence of biota, debris, or redox layer

Sampler Signature: _____

CORE DESCRIPTION



Project Name: _____ Project Location: _____
 Project No.: _____ Core Method: _____

Field Log by: _____	Lab Log by: _____	Field	Lab
Tide Level (MLLW)	Date		
Depth to Mud	S. Time		
Mud Line Elev.	E. Time		

Core Number
Drive Length, ft.
Recover Length, ft.
Recovery Efficiency

DESCRIPTION OF CORE TUBES & TESTS (based on core tube lengths, feet)

Tube No. Ln, ft.	FIELD End Description	Spl No & Test	LABORATORY Sample Description
_1			
_2			
_3			
_4			
_5			
_6			
_7			
_8			
_9			
_10			
_11			
_12			
_13			
_14			
_15			

(based on in-situ depths, feet)

Interpreted Summary Log (1)	Acquisition Data (2)	Blows/Ft. (3)
_1		
_2		
_3		
_4		
_5		
_6		
_7		
_8		
_9		
_10		
_11		
_12		
_13		
_14		
_15		

- 1 The summary log is an interpretation based on samples, blow counts, acquisition data, and interpolation. The recovery efficiency is a rough indication of the general confidence of the summary log. Variation between what is shown and actual conditions should be expected.
 2 11/9 (83%) Penetration Depth, ft./Corresponding Sample Recovery, ft. (Corresponding Total Recovery Efficiency, percent)
 3 Blows/ft. are the number of hammer strikes required to drive the core tube 1 foot.

FIELD SAMPLING PLAN

Expected Mudline Elev _____

Expected Thickness of Recent Sediment _____

Tube Segment			Actual Recovery				Chain-of-Custody of Core Tube Sections Transfer Tube Sections from Field to Lab
No	In Situ Depth	Ln.	Total % R	Core Tube Depth	Length	Segment % R	
A							Relinquished By:
B							Received By:
C							Date:
D							Time:
							Comments:

LAB: SAMPLES SELECTED FOR TESTING

SAMPLE		Sample Depth	
Number	Test	Tube	In-Situ

COMMENTS